CITY OF CARLSBAD

SEWER MASTER PLAN UPDATE

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ANNOTATION

The following abbreviations and acronyms were used in the preparation of this Master Plan:

ADWF	Average Dry Weather Flow
APN	Assessor Parcel Number
BSD	Buena Sanitation Division
CCFRPM	centrifugally cast fiberglass reinforced plastic mortar
CIP	Capital Improvement Program
City	City of Carlsbad
DIP	Ductile iron pipe
EDU	Equivalent Dwelling Unit
EIR	Environmental Impact Report
ESD	Encinitas Sanitary Division, City of Encinitas
EWA	Encina Wastewater Authority
fps	feet per second
GIS	Geographical Information System
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
Hp	horsepower
hr	hour
I&I	Inflow and Infiltration
in	inches
lf	linear feet
LCWD	Leucadia County Water District
LFMZ	Local Facility Management Zone
mgd	million gallons per day
MFDU	multi-family dwelling unit
MG	million gallons
NAH	North Agua Hedionda
NB	North Batiquitos
PDWF	Peak Dry Weather Flow
PWWF	Peak Wet Weather Flow

ANNOTATION (continued)

RCP	Reinforced concrete pipe
SAH	South Agua Hedionda
SanGIS	San Diego County Geographic Information System
SFDU	single family dwelling unit
USGS	United States Geologic Survey
V/C	Vista/Carlsbad
VCP	Vitrified clay pipe
VFD	Variable frequency drive
VWD	Vallecitos Water District
WPCF	Water Pollution Control Facility
WRP	Water Reclamation Plant
WWTP	Waster Water Treatment Plant

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

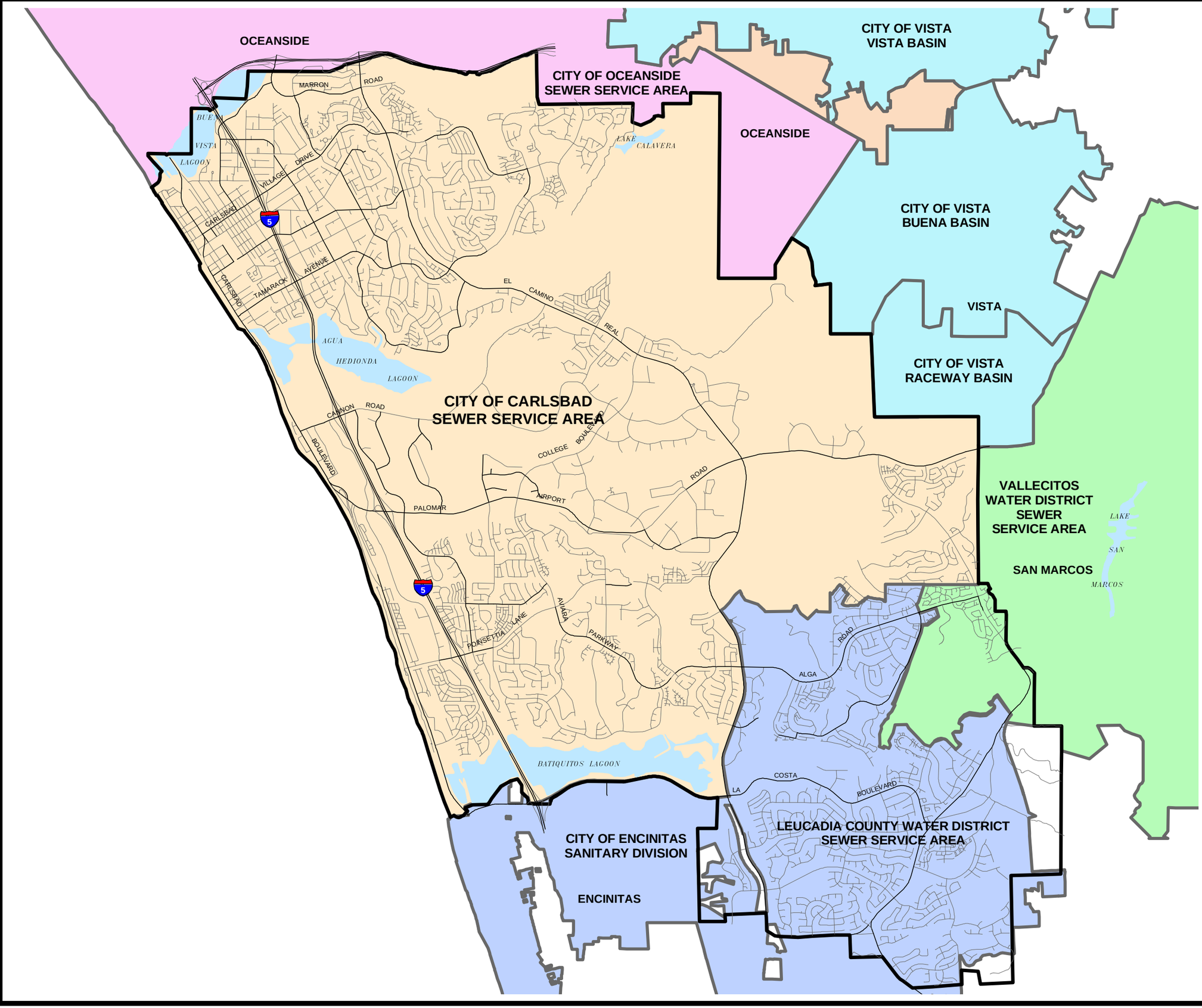
The Carlsbad Sanitary District, formed in 1929, provided the first sewer service to areas now within the City of Carlsbad. A sewage treatment plant and a system of sewer lines, serving the northwest corner of the present village area of the City Carlsbad, were initially constructed with the formation of the Sewer District. Thus, portions of the City's existing conveyance system date back as far as 1929. The original treatment plant location was on the south shore of the Buena Vista Lagoon, adjacent to Carlsbad Boulevard. This is the present location of the Home Plant Lift Station.

The Carlsbad Sanitary District provided sewer service until the City of Carlsbad incorporated in 1952. When the City of Carlsbad incorporated, there were approximately 600 parcels of property being served by the Carlsbad Sanitary District. The City of Carlsbad expanded the sewer system and increased the number of connections. By 1960, it was apparent that a larger treatment facility would be required. To meet the growing regional needs for sewer service, the City of Carlsbad and the Vista Sanitation District jointly constructed the Encina Water Pollution Control Facility (WPCF), located just south of Palomar Airport Road and west of Interstate 5. When the WPCF was put into operation in 1965, wastewater flows to the old Carlsbad Sanitary District plant were diverted to the new treatment facility. The Encina WPCF is now jointly-owned and operated by six northern San Diego County wastewater agencies as the Encina Wastewater Authority (EWA).

1.2 SERVICE AREA OVERVIEW

The City of Carlsbad wastewater service area covers approximately 70 percent of the City limits. Sewer service to the southeast corner of the City is provided by the Leucadia County Water District (LCWD), and the Vallecitos Water District (VWD) provides service to the Meadowlark area along the eastern City limit. The Carlsbad service area boundary and adjacent district boundaries are shown on Figure 1-1.

The elevation of the service area varies from just under 600 feet at the eastern boundary to sea level along the coast and lagoon shores. The service area is comprised of five major drainage basins, which extend from approximately the eastern service area boundary, and drain west to the coast and ultimately the Encina WPCF. These sewage drainage basins are defined by the existing and planned interceptors within the City of Carlsbad. In addition to the gravity interceptors, a number of lift stations are required to convey wastewater flows to the Encina WPCF. The major drainage basins are shown on Figure 1-2.



CITY OF CARLSBAD
CALIFORNIA
INCORPORATED 1952

LEGEND

- SEWER SERVICE AREA BOUNDARY
- CITY OF CARLSBAD BOUNDARY

N

1"=4500'

FIGURE 1-1

CITY OF CARLSBAD
SEWER SERVICE AREA

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The northern-most drainage basin in the City is the Vista/Carlsbad (V/C) basin. The V/C basin begins at the northeast Carlsbad boundary and extends west, with an area that extends approximately ½ mile south of Highway 78 and, further west, to the Buena Vista Lagoon. At the Buena Vista Lagoon, the basin turns south and extends along the coast. The basin includes areas west of Interstate 5 from the Buena Vista Lagoon to the Encina WPCF.

Adjacent to the V/C basin to the south is the North Agua Hedionda (NAH) drainage basin. This basin drains to the north shore of the Agua Hedionda Lagoon and then into the V/C basin.

The next drainage basin to the south is the South Agua Hedionda (SAH) basin. This basin generally follows the Agua Hedionda Creek from the City of Vista boundary to the Agua Hedionda Lagoon, and then continues west along the south side of the lagoon before draining to the V/C basin. The SAH basin is approximately two miles wide at the eastern City boundary, and narrows to about ½ mile wide at its western boundary with the V/C basin.

The drainage basin that includes the Encinas Canyon area is called the Buena/Vallecitos basin, since it is served by two separate interceptors. This basin contains a portion of the Batiquitos Lagoon drainage area, which is also referred to as the North La Costa area. The drainage area begins at the eastern boundary of the service area adjacent to the Vallecitos Water District, and extends west to the Encina WPCF.

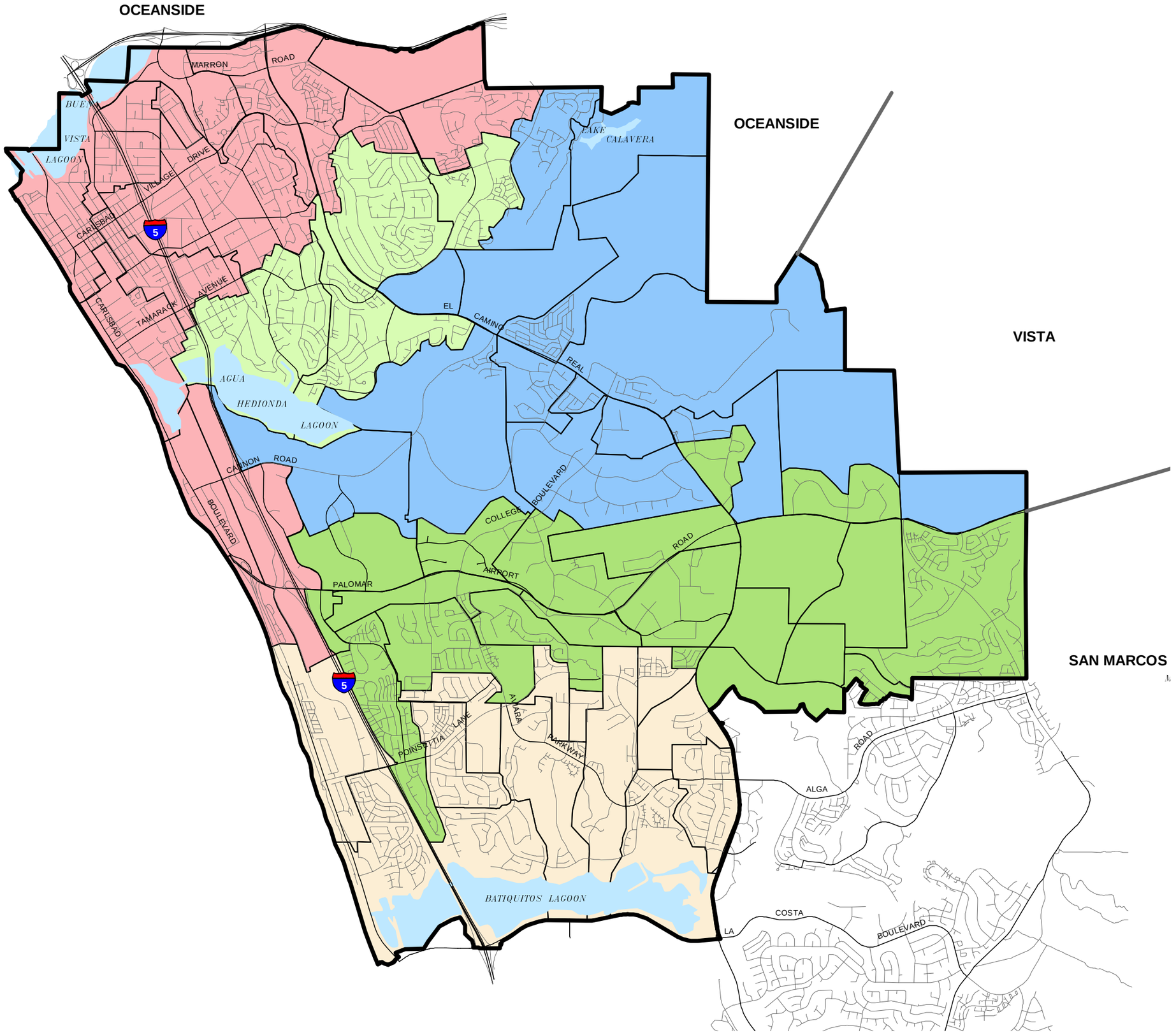
The most southerly sewer drainage basin is the North Batiquitos basin. This basin begins at El Camino Real and extends west along the north shore of the Batiquitos Lagoon to Interstate 5. At Interstate 5, the basin turns north and follows the coast to the Encina WPCF.

1.3 GROWTH MANAGEMENT PLAN

On July 1, 1986, the City Council of Carlsbad adopted a Growth Management Plan to help assure provision of adequate facilities for future development. Implementation of the Growth Management Program was envisioned as a three level system, involving 1) a Citywide Facilities and Improvement Plan, 2) the preparation of 25 Zone Facilities Plans, and 3) individual project approvals. The Citywide Plan established the following standards for sewer collection and wastewater treatment:

- SEWER COLLECTION SYSTEM PERFORMANCE STANDARD – Trunk line capacity to meet demands as determined by the appropriate sewer district must be provided concurrent with development.

- WASTEWATER TREATMENT CAPACITY PERFORMANCE STANDARD – Sewer plant capacity is adequate for at least a five year period.



CITY OF CARLSBAD
CALIFORNIA

LEGEND

- SEWER SERVICE AREA BOUNDARY

MAJOR DRAINAGE BASINS

- VISTA/CARLSBAD
- NORTH AGUA HEDIONDA
- SOUTH AGUA HEDIONDA
- BUENA/VALLECITOS
- NORTH BATIQUITOS

N

1"=4000'

FIGURE 1-2

CITY OF CARLSBAD
MAJOR DRAINAGE BASINS

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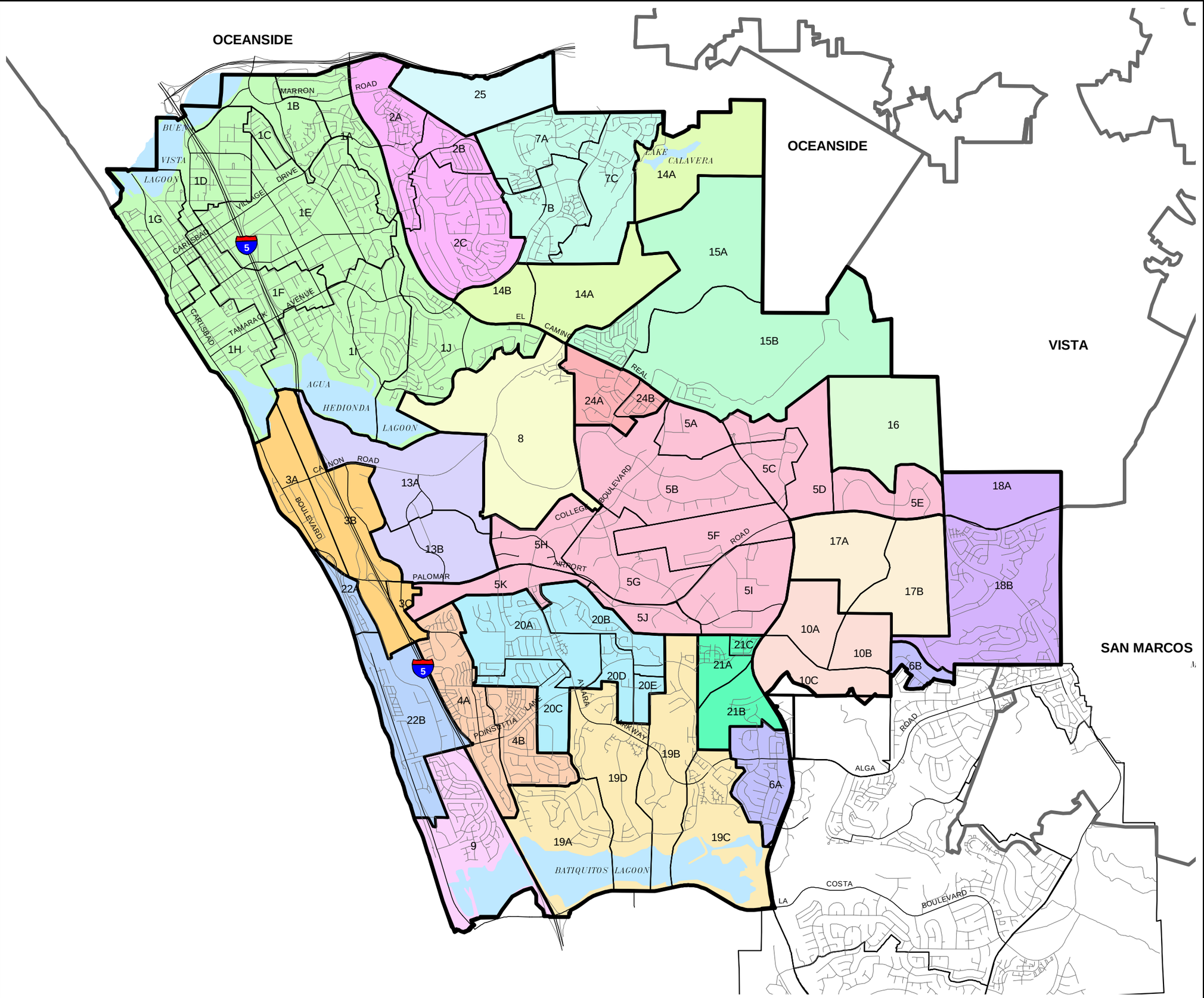

CITY OF CARLSBAD
CALIFORNIA

LEGEND

- SEWER SERVICE AREA BOUNDARY
- 5 LFMZ BOUNDARY
- SUB BASIN BOUNDARY & DESIGNATIONS

LFMZ'S BY COLOR

1	8	17
2	9	18
3	10	19
4	13	20
5	14	21
6	15	22
7	16	24
		25

N

1"=4000'

FIGURE 1-3

CITY OF CARLSBAD
LFMZ AND SUB-DRAINAGE BASIN BOUNDARIES

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As part of the Growth Management Plan, the City of Carlsbad was partitioned into 25 separate planning areas. These planning areas are identified as Local Facility Management Zones (LFMZs). The City of Carlsbad Sewer Service Area includes all or portions of LFMZs 1-10, 13-22, 24 and 25.

Some of these planning areas fall into more than one sewer drainage basin. The LFMZs were sub-divided in the 1992 Master Plan of Sewerage to project flows for specific sewer drainage basins. These sub-zones, referred to as sub-drainage basins or sub-basins, have been revised in this Master Plan Update to more accurately allocate and distribute existing and future flows to the sewer interceptors. The LFMZs and current sub-basin designations used throughout this report are illustrated on Figure 1-3.

1.4 PREVIOUS MASTER PLANS

Summaries of the three most recent Sewer Master Plans are provided in the following sub-sections.

1.4.1 1987 Master Plan of Sewerage

The 1987 Master Plan of Sewerage was the first master plan prepared in accordance with City of Carlsbad Growth Management Plan. In 1987, the majority of development in Carlsbad was along the coastal strip and predominantly residential. The population of the 1987 study area was estimated at 39,000, and the ultimate population was projected to be 95,700. Average wastewater flows were projected at a rate of 220 gallons per day per equivalent dwelling unit (EDU). In 1987, the ultimate average flow from the City of Carlsbad was projected to be 13.41 million gallons per day (MGD).

1.4.2 1992 Master Plan of Sewerage

The 1992 Master Plan of Sewerage was an update of the 1987 Master Plan. By 1992, the population of the study area had increased to 65,000 and the ultimate population projection had increased to 130,000. Development was starting to progress inland and the percentage of commercial/industrial development had increased since the last Master Plan. The projected population growth curve first developed in the 1987 Master Plan was revised to increase more rapidly through the year 2000, and then flatten out to an annual growth rate of approximately 1 percent from the year 2000 to buildout. In 1992, the ultimate average flow projection was increased slightly from the 1987 projection to an estimated flow of 13.84 MGD.

Major improvements to the 1992 sewer system recommended in this update included capacity upgrades to the Vista/Carlsbad Interceptor, replacement of the Home Pant Lift Station, and the construction of gravity sewers to lift stations in LFMZs 2 and 7. It was also recommended to divert wastewater flows from the Palomar Oaks Business Park area, located north of Palomar Airport Road and east of El Camino Real, from the South Agua Hedionda Drainage Basin into the Buena Interceptor.

1.4.3 1997 Sewer Master Plan Update

In 1994, the City of Carlsbad adopted a new General Plan. The 1997 Sewer Master Plan Update incorporated the revised 1994 land use and population projections. Because ultimate population projections were reduced only slightly from those used in the previous Master Plan, an updated capacity analysis of the interceptors was deemed unnecessary. The 1997 Master Plan Update focused on analyses of the NAH and SAH sewer basins to determine whether excess hydraulic capacity in the NAH Interceptor could be used to convey portions of the SAH flows. Preliminary sizing, slope and alignment of the SAH Interceptor was performed as part of this update. Also included in the update were additional hydraulic analyses of the V/C Interceptor and a detailed survey of the existing lift stations.

1.5 2003 UPDATE SCOPE AND PURPOSE

This report represents an update of the City of Carlsbad Sewer Master Plan (Master Plan) for the planning period between 2002 and buildout of the District's service area. In summary, the scope includes tasks to document existing facilities, project ultimate average wastewater flows, estimate existing and ultimate peak flows, and develop a computer model to perform an existing and ultimate system capacity analysis. The outcome of these analyses is a recommended long-term Capital Improvement Program (CIP) for improvement of existing wastewater collection and treatment facilities. An update of the sewer connection fee is included to finance the recommended facilities, and an out-of-basin sewer study for the SAH basin is included to determine when the future SAH Interceptor may be required.

A major task included in the Master Plan scope is the development of a Geographical Information System (GIS) for the sewer collection system. The sewer GIS was used to create a computer model of the interceptor system and produce maps of the collection system for this report. The completed sewer GIS and supporting documentation has been submitted under a separate cover. Supporting environmental documentation in compliance with the California Environmental Quality Act (CEQA) for the projects identified in the CIP will also be submitted in a separate document.

In this Master Plan Update, ultimate sewer flow projections are based on the City's recently compiled Growth Database, which projects the number of additional single and multi-family units and the number and size of non-residential buildings at buildout. The capacity analyses are performed with a state-of-the-art hydraulic model based on the newly developed sewer GIS. Major improvements over previous modeling efforts include: 1) a single integrated model of the sewer collection system, 2) an accurate representation of the Vallecitos and Buena Interceptors (modeled as a combined interceptor in the previous Master Plans), 3) the determination of existing peak wet weather flows from available meter data, and 4) analysis using extended period simulations, which account for travel time in the determination of peak flow rates.

CHAPTER 2
EXECUTIVE SUMMARY

2.1 INTRODUCTION AND SCOPE

The City of Carlsbad Sewer Master Plan Update documents the existing sewer collection system and identifies required facilities for the buildout of the District's service area, anticipated to occur by the year 2020. The scope for this update includes tasks to document existing facilities, project ultimate wastewater flows, estimate existing and ultimate peak flows, and develop a computer model to perform an existing and ultimate system capacity analysis of the interceptor system. The outcome of the analysis is a recommended long-term Capital Improvement Program (CIP). An update of the sewer connection fee is included to finance the recommended facilities.

A major task included in the Master Plan Update scope is the development of a Geographical Information System (GIS) for the sewer collection system. The sewer GIS was used to create a computer model of the interceptor system and produce maps of the collection system for this report. The completed sewer GIS and supporting documentation were submitted to the City under a separate cover in February 2003. Supporting environmental documentation in compliance with the California Environmental Quality Act (CEQA) for the projects identified in the Master Plan Update CIP will also be submitted separately at a later date.

In this Master Plan Update, ultimate sewer flow projections are based on the City's recently compiled Growth Database, which projects the number of additional single and multi-family units and the number and size of non-residential buildings at buildout. The capacity analyses are performed with a state-of-the-art hydraulic model based on the newly developed sewer GIS. Major improvements over previous modeling efforts include: 1) a single integrated model of the sewer collection system, 2) an accurate representation of the Vallecitos and Buena Interceptors (modeled as a combined interceptor in the previous Master Plans), 3) the determination of existing peak wet weather flows from available meter data, and 4) analysis using extended period simulations, which account for travel time in the determination of peak flow rates.

2.2 EXISTING SYSTEM OVERVIEW

The City of Carlsbad Sewer Service Area includes the majority of the City, with the exception of the southeast corner of the City. Wastewater collection in the southeastern area is provided by the Vallecitos Water District (VWD) and the Leucadia County Water District (LCWD). Carlsbad's Sewer Service Area extends from the Pacific Coast approximately 5 miles inland, providing wastewater collection, treatment and disposal service to customers within its 30 square mile service area. Wastewater is conveyed to the

Encina Water Pollution Control Facility (WPCF) for treatment and disposal through an ocean outfall. The Encina WPCF is owned and operated by the Encina Wastewater Authority (EWA), a joint powers authority made up of six northern San Diego County wastewater agencies.

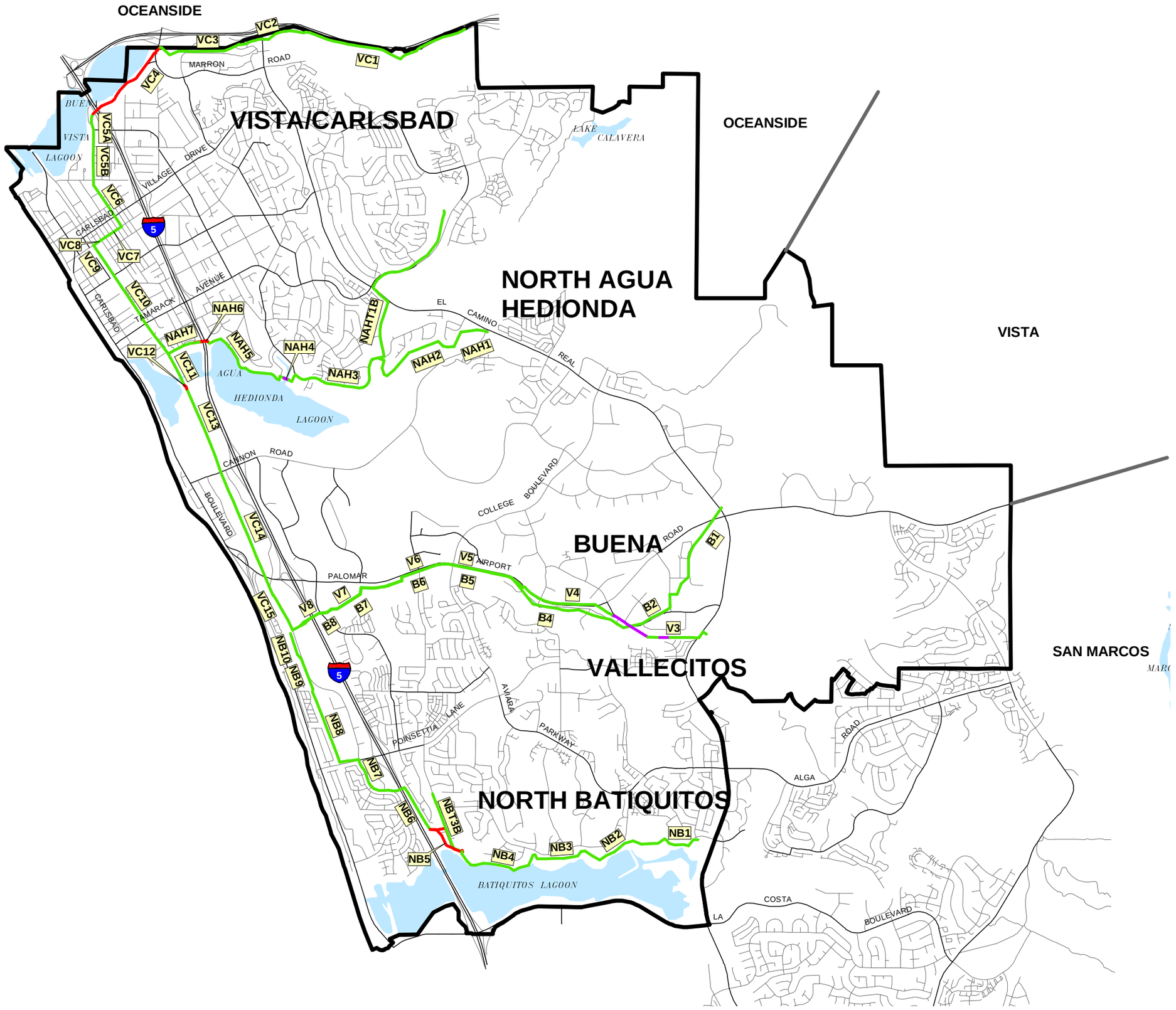
The City of Carlsbad sewer service area is comprised of five major drainage basins, which extend from approximately the eastern service area boundary, and drain west to the coast and ultimately to the Encina WPCF. These sewage drainage basins are defined by the existing and planned interceptors within the City of Carlsbad. Four of the interceptor systems have been constructed and are now in use. Most interceptors convey upstream flows from other agencies in addition to City of Carlsbad flows. The existing interceptor systems in order from north to south are listed below.

- **Vista/Carlsbad (V/C) Interceptor** - collects City of Vista and Carlsbad flows. Jointly owned by the City of Vista and the City of Carlsbad
- **North Agua Hedionda (NAH) Interceptor** - conveys only City of Carlsbad wastewater.
- **Buena/Vallecitos Interceptor system** – consists of two separate interceptors sharing a common alignment through the Encinas Canyon: the Buena Interceptor, owned by the City of Vista's Buena Satiation District, and the Vallecitos Interceptor. The City of Carlsbad has capacity rights in the Buena Interceptor and the City of Carlsbad, City Vista and the VWD share capacity ownership in the Vallecitos Interceptor.
- **North Batiquitos (NB) Interceptor** - collects only Carlsbad flows in the upper reaches. The last approximately half mile before the Encina WPCF is jointly owned by the City of Carlsbad, the LCWD, and the Encinitas Sanitary Division of the City of Encinitas. The combined ownership section is sometimes referred to as the Ponto Interceptor or the Occidental Sewer.

In addition to the approximately 30 miles of interceptor sewers, the City of Carlsbad currently owns, operates, and maintains approximately 200 miles of gravity collector system pipelines and approximately 5,000 manholes. Eighteen wastewater lift stations are currently located within the City of Carlsbad Sewer Service Area. The Buena Vista and Agua Hedionda Lift Stations, which are part of the V/C Interceptor, are operated and maintained by the Encina Wastewater Authority. The remainder of the lift stations are owned and operated by the City of Carlsbad. Exhibit 1 in Appendix A provides an illustration of the existing wastewater collection and conveyance system and Figure 2-1 illustrates the interceptor reach designations used throughout this Master Plan Update.

2.3 EXISTING WASTEWATER FLOWS

As population has grown and the northern coastal areas of San Diego County continue to develop, the City of Carlsbad has experienced gradually increasing wastewater volumes. The Encina Wastewater Authority operates and maintains numerous flow meters throughout the service areas of its six member agencies. A Centralized Flow Metering Program was implemented in 1989 and meter upgrades were last



CITY OF CARLSBAD
CALIFORNIA

LEGEND

- SEWER SERVICE AREA BOUNDARY

SEWER INTERCEPTOR SYSTEM

- GRAVITY SEWER
- FORCEMAIN
- SIPHON

N

1"=4000'

FIGURE 2-1

CITY OF CARLSBAD
EXISTING INTERCEPTOR SYSTEM

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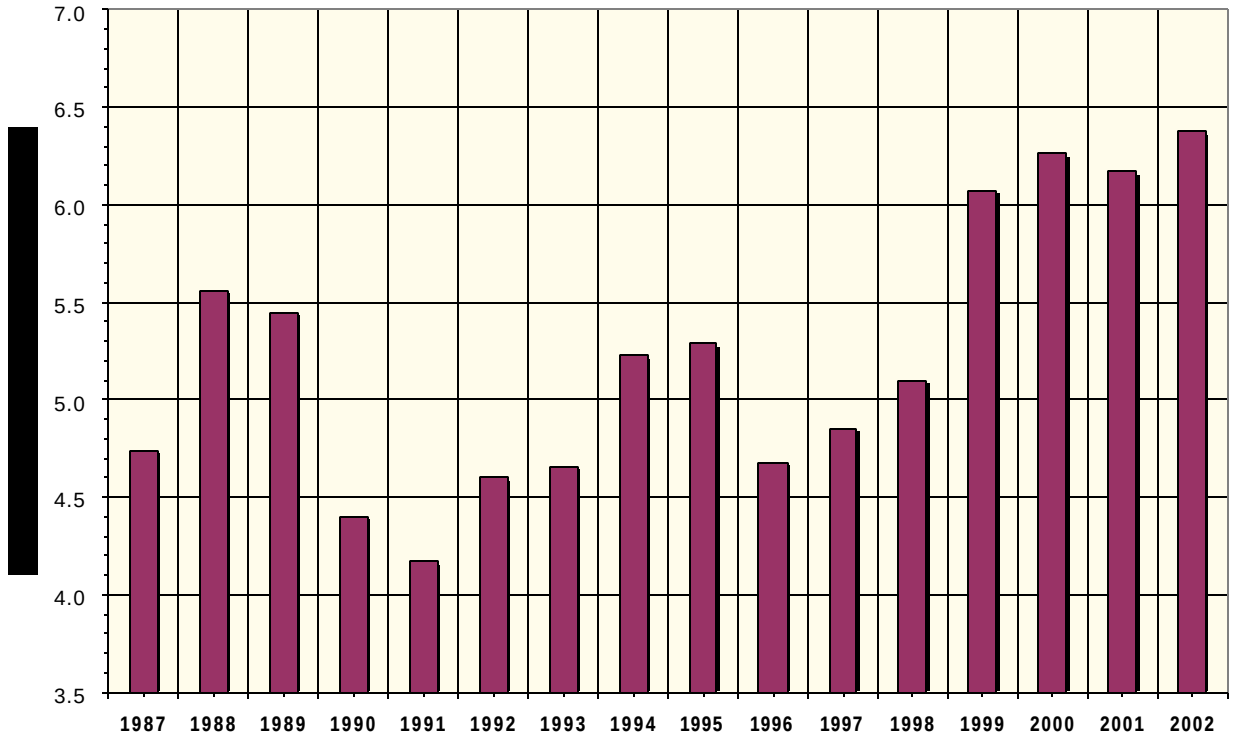
made in 1996. Wastewater flows generated within the City of Carlsbad are metered in the interceptor pipelines upstream of the Encina WPCF. Because of flow contributions from upstream agencies, Carlsbad flows must be determined by subtracting other agency flows from measured flows at the WPCF.

Carlsbad average annual wastewater flows, as calculated from Encina meter data, are summarized for the past 15 years on Figure 2-2. As shown on the chart, wastewater flows decreased significantly after 1989. This was typical of most Southern California sewage agencies, and can be attributed to conservation measures implemented during drought conditions. Some of the conservation measures were temporary but many, such as the installation of low-flow bathroom fixtures, have had a lasting effect. Flow meters were replaced at the beginning of 1996, and the improved accuracy may have contributed to the flow decrease observed after 1995. It is only over the past four years that wastewater flows have surpassed flows generated in the late 1980's. The higher flows are a result of steady increases population, as land use within the service areas has transitioned from mainly agricultural use to urbanized development.

Figure 2-2
HISTORICAL WASTEWATER FLOWS



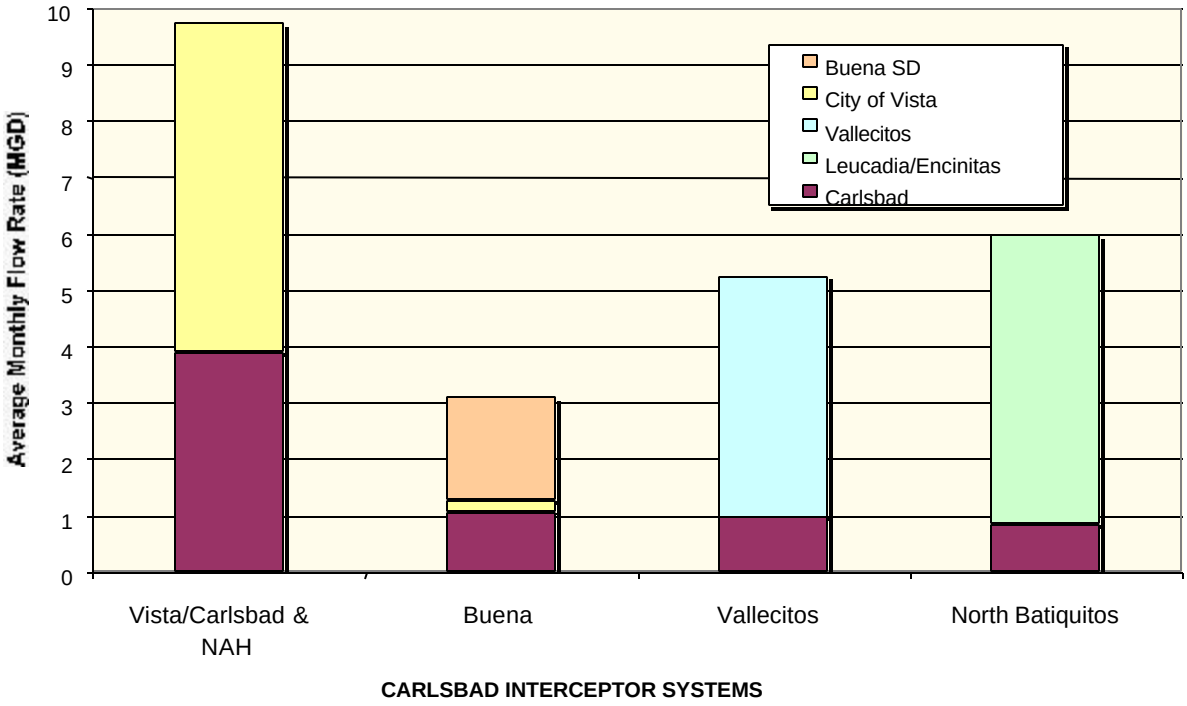
For this Master Plan Update, EWA meter data for August 2001 was used to determine the existing average dry weather flow (ADWF). The month of August was selected because it was the most recent month during the dry season in which all meters appeared to be operating properly and complete flow data could be obtained. Table 2-1 summarizes the average flow for Carlsbad and the other EWA agencies for August 2001. This information is illustrated graphically by interceptor system on Figure 2-3.

Table 2-1
AUGUST 2001 ENCINA MEMBER AGENCY FLOW SUMMARY

Interceptor System	Carlsbad Flows	Other Agency Flows		Total Flow
		Agency	Flow	
Vista/Carlsbad & NAH	3.89 MGD	City of Vista	5.84 MGD	9.73 MGD
Buena	1.06 MGD	Buena Vista (raceway)	1.84 MGD 0.20 MGD	3.10 MGD
Vallecitos	0.97 MGD	Vallecitos	4.28 MGD	5.25 MGD
North Batiquitos*	0.56 MGD	Leucadia/Encinitas	5.14 MGD	5.70 MGD
Totals	**6.48 MGD**		**17.30 MGD**	**23.78 MGD**

* Metered flow at EWPCF is .28 MGD less than the upstream flow metered at the North Batiquitos Lift Station.

Figure 2-3
AUGUST 2001 FLOW SUMMARY BY INTERCEPTOR



From Figure 2-3, it is apparent that Carlsbad flows comprise a minority of the total flows in each of the interceptors. This is especially true in the North Batiquitos Interceptor, for which the Carlsbad flow proportion is less than 10 percent of the total flow measured at the Encina WPCF. Because Carlsbad flows are calculated by subtracting upstream and downstream flow meter readings, the resultant flows are dependent on the accuracy of the meters. If the Carlsbad flow contribution is very small relative to the upstream flows, an error of 5 percent on the upstream and downstream readings (the rated accuracy of the gravity flow meters under ideal flow conditions) can have a large effect on the calculated flow for Carlsbad.

Flow generation factors based on existing flow conditions were developed to distribute flow in the existing system hydraulic computer model. Sewer flow factors were derived from August 2001 Encina flow meter data, parcel information contained in the City's Growth Database, and City of Carlsbad water billing records, which were assigned an assessor parcel number (APN) by City staff. The average unit flow per residential unit for the existing Carlsbad sewer system is calculated to be approximately 195 gpd/EDU. It is noted that the flow generation factors based on existing conditions are different than the flow factors developed to project future flows.

2.4 EXISTING SYSTEM EVALUATION

A new model of the Carlsbad interceptor system was developed from GIS data collected as apart of this Master Plan Update. The evaluation method employs the use of the *SewerCAD* hydraulic modeling software, which performs hydraulic calculations based on standard open channel flow algorithms and Manning's equation. *SewerCAD* performs extended period simulations (EPS) to route wastewater flows through the conveyance system using a unit hydrograph or diurnal curve. The result of this analysis technique is a more accurate depiction of the true peaking factor within the subject collection system.

Information from City of Carlsbad water billing records was associated with the City's parcel base, and then used to distribute internal flows to the interceptor system model. Peak dry and wet weather flows were input to the model using hydrographs (diurnal curves) developed from 24-hour metering data. The peaking curves developed for upstream agency flows are illustrated on Figure 2-4 and the unit hydrographs applied to Carlsbad flows are shown on Figure 2-5. It is noted that a total flow rate of 6.8 MGD for City of Carlsbad flows was used in the existing system analysis, which is slightly higher than the actual totals calculated based on the August 2001 Encina meter records. A higher flow was used for the North Batiquitos Interceptor based on flow meter data from the North Batiquitos Lift Station.

Figure 2-4
DRY WEATHER HYDROGRAPHS FOR EXTERNAL LOADS

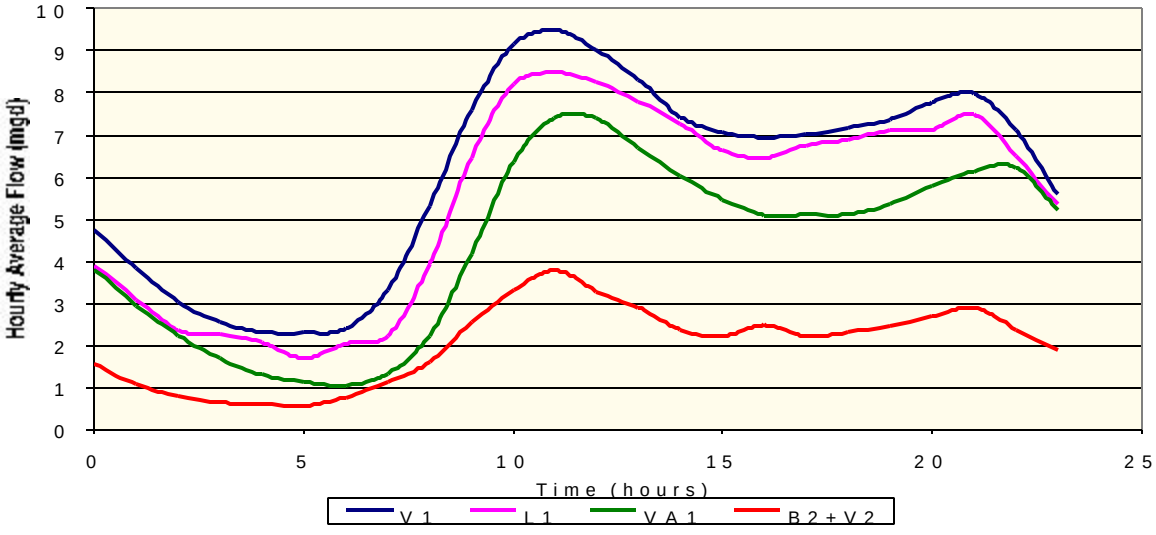
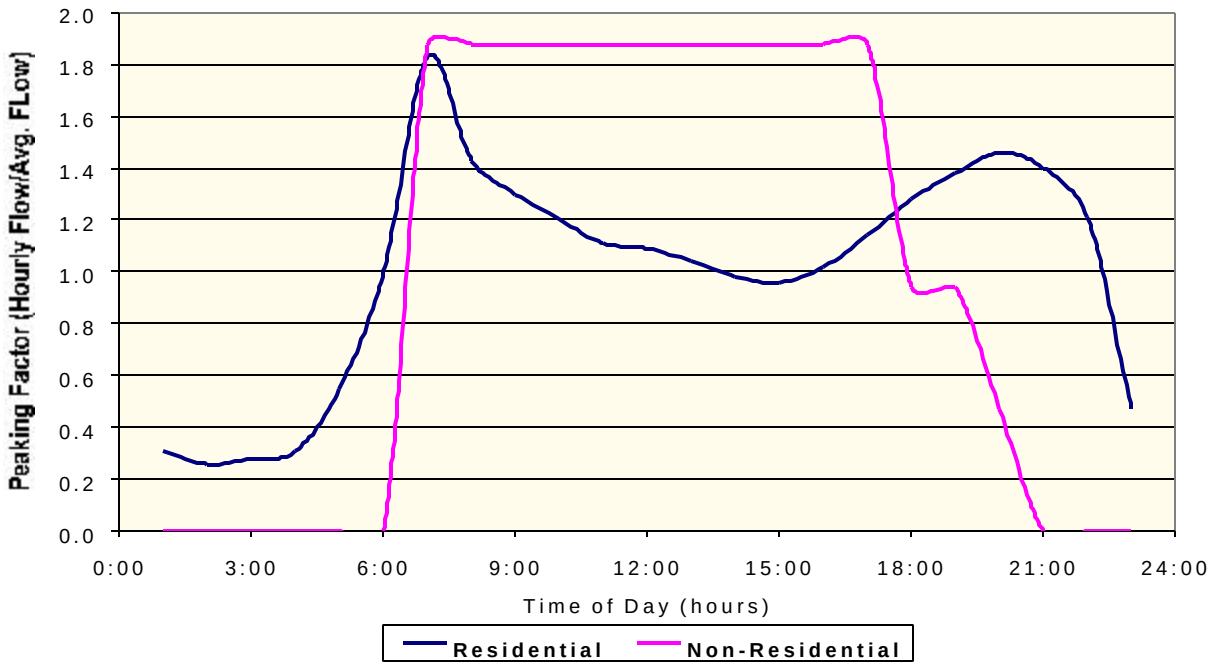


Figure 2-5
DRY WEATHER UNIT HYDROGRAPHS FOR INTERNAL LOADS



To evaluate the operation of the existing system during peak flow periods, wet weather flows were analyzed and compared to dry weather flows. Flow metering data from five storm events was reviewed and a single storm was selected to determine inflow and infiltration rates (I&I) in the system. The storm event selected for analysis occurred on November 24, 2001. The total rainfall amount for this storm was 1.29 inches with a peak intensity of 0.55 inches/hour. The rainfall occurred during an off-peak flow period and lasted for approximately 4 hours. Peak wet weather flow curves were developed based on observed inflow rates from November 24, 2001 meter data, assuming that the storm event occurred during the daily peak flow period. Table 2-2 summarizes the I&I applied in the existing system wet weather hydraulic analysis based on this flow analysis.

Table 2-2
EXISTING SYSTEM ANALYSIS PEAK I&I RATES

Model ID	Description	Flow Rate (MGD)
V1	City of Vista External Inflow	2.6
272	City of Vista External Infiltration	3.0
VC_IntWx	Carlsbad Internal I&I to V/C	4.7
B2_V2	Buena/Raceway External I&I	1.1
437	Carlsbad Internal I&I to Buena	0.5
VA1	Vallecitos External I&I	3.5
L1	Leucadia External I&I	2.1
	TOTAL ESTIMATED I&I	**17.4**

Hydraulic analyses were performed on the existing interceptor system with both dry and wet weather flows. Capacity analysis of open channel systems is generally based on the consideration of the depth of flow as compared to the diameter of the pipe (D/d). The capacity analysis under dry weather flow conditions indicates that two flat pipeline reaches in VC14 and VC15 are flowing full. There is a very flat 400-ft segment in VC14 with a slope of less than 0.01 percent that is calculated to have a capacity of 5.5 MGD, and a 20-foot segment in VC15 was found to have a slightly negative slope. The pipelines in these two sections currently operate under pressure flow conditions. There are a few isolated locations where flows exceed the 75 percent full criteria in the Buena Interceptor, also due to short sections of very flat pipeline.

Based on analysis of the existing collection system with wet weather flows, several gravity pipelines were determined to be deficient with respect to the City's design criteria (pipelines over 12-inch in diameter should not flow more than 75 percent full with peak wet weather flows). It is noted that the peak wet weather event modeled is conservatively based on potential flows and I&I rates that could occur, and is not based on actual recorded flows. The potentially deficient pipeline reaches identified during the existing system analyses are located within four separate areas of the interceptor system, as documented in Table 2-3.

Table 2-3
EXISTING PWWF ANALYSIS SUMMARY FOR GRAVITY PIPELINES

Model ID	Reach	Length (ft.)	Diam. (ft.)	Location/Comments
274-281	VC3	2,830	36	Approach to Buena Vista Lift Station - pipeline flowing 75% full
309-310	VC11	896	42	Approach to Agua Hedionda Lift station - localized surcharging
300-307	VC13	3,510	42	Downstream of Agua Hedionda Lift Station - pipeline capacity is exceeded for short periods; two very flat sections (reaches 290 and 288) and one short 20' pipe with neg. slope (reach 287)
290-298	VC14	4,530	42	
283-289	VC15	1,860	42	
194	B4	594	18	Upper Buena, localized surcharging in very flat reach
1	B7	596	24	Lower Buena, localized surcharging in very flat reach
392	B8	208	30	Lower Buena, isolated flat sections
377	B8	93	30	

The longest sections of pipeline in Table 2-3 are in the Vista/Carlsbad Interceptor in Reach VC-3, which is upstream of the Buena Vista Lift Station, and Reaches VC-13-15, which are downstream of the Agua Hedionda Lift Station. These pipeline reaches are planned for future capacity upgrades, and the replacement pipelines are sized based on ultimate flows in the next chapter of this report. The other two areas with existing capacity deficiencies are short sections of pipeline in the upstream and extreme downstream reaches of the Buena Interceptor. These pipelines are flowing full because of isolated reaches with very flat slopes.

Table 2-4 summarizes the peak flow tributary to the lift stations and the peak forcemain velocities exhibited based on existing flows. Estimates of peak wet weather flows are provided for the V/C Interceptor, but only peak dry weather flows are calculated for the NAH and NB Interceptors due to a lack of wet weather flow monitoring data.

Table 2-4
EXISTING POTENTIAL PEAK FLOWS TO INTERCEPTOR LIFT STATIONS

Lift Station	Lift Station Firm Capacity (MGD)	PDWF to Wet Well (MGD)	PWWF to Wet Well (MGD)	Peak Velocity in Force Main[1] (fps)
Buena Vista	21.5	10.2	18.9	6.9 [2]
Agua Hedionda	23.0	15.3	24.2	10.6
Foxes Landing	3.7	2.24	---[3]	4.4
North Batiquitos	3.2	1.47	---[3]	2.6

(1) Velocity is based on the peak influent flow to the station for variable speed pumps. For the NB Lift Station (fixed speed), the velocity is based on the output of a single pump.
(2) Peak velocity in the parallel 16" & 24" section. Velocity is 9.3 fps in the short, single 24" section and 10.5 fps in the parallel 16" section in the bridge over I-5
(3) Metering data to determine wet weather flows is not available for this system

From the data in Table 2-4, it can be concluded that the North Batiquitos Lift Station has sufficient capacity for current wet weather flow conditions based on the 1.7 MGD of available pumping capacity under dry weather conditions. It is less clear if there is sufficient capacity for wet weather flows at the Foxes Landing Lift Station. Based on the PDWF to the Foxes Landing Lift Station, there is approximately 1.4 MGD of available pumping capacity to convey stormwater flows. The downstream reaches of the AH Interceptor are along the north shore of the Agua Hedionda Lagoon, and are potential sources of I&I to the interceptor system with rising water levels in the lagoon. Wet weather flow data is needed to estimate the existing I&I to this system, and to determine if there is sufficient available capacity at the lift station.

For the V/C Interceptor a hydraulic analysis of peak wet weather flows was performed. Results indicate that the Buena Vista Lift Station may be potentially operating near its firm capacity during severe storm events, and the capacity of the Agua Hedionda Lift Station could potentially be exceeded for brief periods. Velocities in the Agua Hedionda forcemain and portions of the Buena Vista forcemain are also exceeding the recommended maximum velocity of 8.0 fps during peak wet weather flow conditions.

2.5 ULTIMATE FLOW PROJECTIONS

Future flow projections are used to determine required upgrades to the existing collection system to adequately serve Carlsbad's wastewater conveyance needs under buildout conditions. The existing interceptor system, with the addition of the South Agua Hedionda Interceptor, is analyzed with projected

peak ultimate flows to identify and size required interceptor capacity improvements. Planned improvements to the collection system were also considered to accurately model future flows. Planned improvements include the elimination of nine lift stations, which will accomplished by the construction of new gravity pipelines. Most of these lift stations are currently pumping out-of-basin. The proposed ultimate collection system is illustrated on Exhibit B in Appendix A.

Build-out projections for the City of Carlsbad have been recently updated and compiled into a Growth Database, which is maintained by the City. Over half of the projected growth in the City of Carlsbad Sewer Service Area is associated with known, planned developments in the eastern portion of the City. These developments include Kelly Ranch, Villages of La Costa, Calavera Hills, Mandana Properties, and Robertson Ranch, which are primarily residential developments, and the Carlsbad Oaks North and Faraday Business Parks, and Bressi Ranch, which will have a mixed-land use. The remainder of future growth in the City of Carlsbad is projected to include smaller, non-specific developments and general "infill" of established neighborhoods and commercial areas located in the western portions of the City.

Flow generation factors are used in conjunction with the City's Growth Database to project ultimate wastewater flows and distribute flows in the ultimate system hydraulic analysis. The City's established planning value for wastewater flow is 220 gpd/EDU. Flow factors typically used for design in sewer systems throughout San Diego County range between approximately 208 gpd/EDU in the City of Encinitas, to approximately 265 gpd/EDU in the City of Chula Vista. Based on these comparisons and the calculated unit flow rate for current conditions (195 gpd/EDU), the previously established flow generation rate of 220 gpd/EDU is considered to be appropriately conservative for flow projections for this Master Plan Update. The unit flow factors developed to project ultimate wastewater flows from data in the City's Growth Database are as follows:

Single-family dwelling unit	- 220 gallons per day
Multiple-family dwelling unit	- 160 gallons per day
Non-residential	- 1,150 gallon per day/10,000 sqft of building area

Based on these unit flow factors, the ADWF flow for the ultimate sewer system is projected to be approximately 9.9 MGD. This value represents an increase of approximately 3.1 MGD, or 45 percent, over existing wastewater flows. Figure 2-6 presents historical flows and the projected ultimate flow, and makes a comparison with previous flow projections. Ultimate flow projections from other agencies that discharge to the Carlsbad sewer system were obtained from recent planning documents. Table 2-5 lists the total projected ultimate flow to the Encina WPCF from its member agencies, and allocates the flow to the Carlsbad interceptor systems.

Figure 2-6
HISTORICAL AND PROJECTED ULTIMATE FLOWS

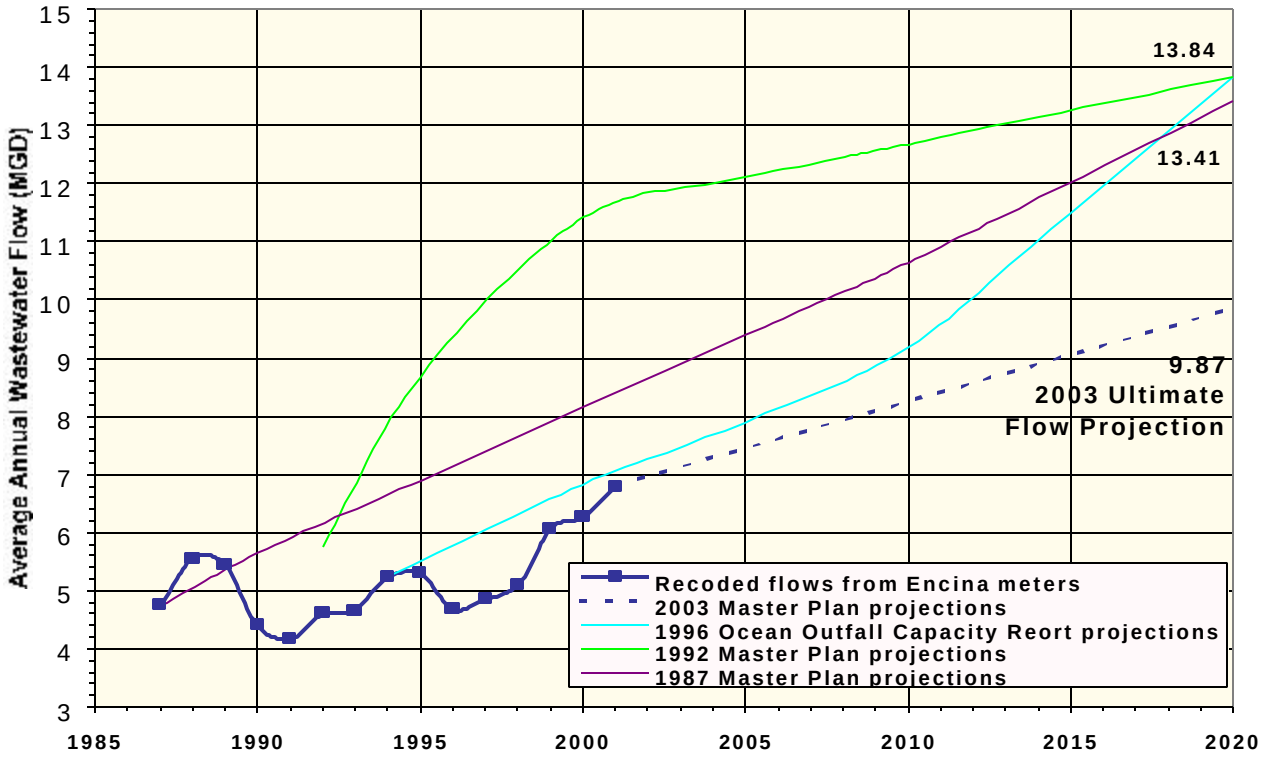


Table 2-5
EXISTING AND PROJECTED ULTIMATE ADWF TO THE ENCINA WPCF

Interceptor System	Existing Flows (Aug 2001)				Projected Ultimate Flows			
	Carlsbad Flows	Other Agency Flows		Total Flow	Carlsbad Flows	Other Agency Flows[1]		Total Flow
		Agency	Flow			Agency	Flow	
Vista/ Carlsbad	2.55 MGD	City of Vista & Oceanside	5.84 MGD	8.39 MGD	2.83 MGD	City of Vista & Oceanside	9.72 MGD	12.55 MGD
North Agua Hedionda	1.30 MGD	---	---	1.30 MGD	1.07 MGD	---	---	1.07 MGD
South Agua Hedionda	---	---	---	---	1.87 MGD	---	---	1.87 MGD
Buena	0.73 MGD	Buena Vista (raceway)	1.84 MGD 0.20 MGD	2.77 MGD	0.88 MGD	Buena Vista (raceway)	3.31 MGD 0.60 MGD	4.79 MGD
Vallecitos	0.90 MGD	Vallecitos	4.28 MGD	5.18 MGD	1.54 MGD	Vallecitos	11.04 MGD	12.58 MGD
North Batiquitos	1.33 MGD	Leucadia/ Encinitas	5.14 MGD	6.47 MGD	1.67 MGD	Leucadia/ Encinitas	8.01 MGD	9.68 MGD
Totals:	**6.81 MGD**		**17.3 MGD**	**24.1 MGD**	**9.87 MGD**		**32.7 MGD**	**42.5 MGD**

(1) Other agency ultimate flow projections obtained from their most recent master planing documents

From Table 2-5 it is apparent that flows from Carlsbad will increase within all existing interceptors except the NAH Interceptor. The majority of the flow increase to the V/C Interceptor is projected to be generated by the City of Vista. The ultimate flows apportioned to the Buena and Vallecitos Interceptors will exceed the capacity of the existing pipelines during peak flow conditions. The City of Vista is planning to divert a portion of their flow from the Buena Interceptor to the Vallecitos Interceptor in the future, and the VWD is planning a replacement of the Vallecitos Interceptor with increased capacity.

2.6 ULTIMATE SYSTEM EVALUATION

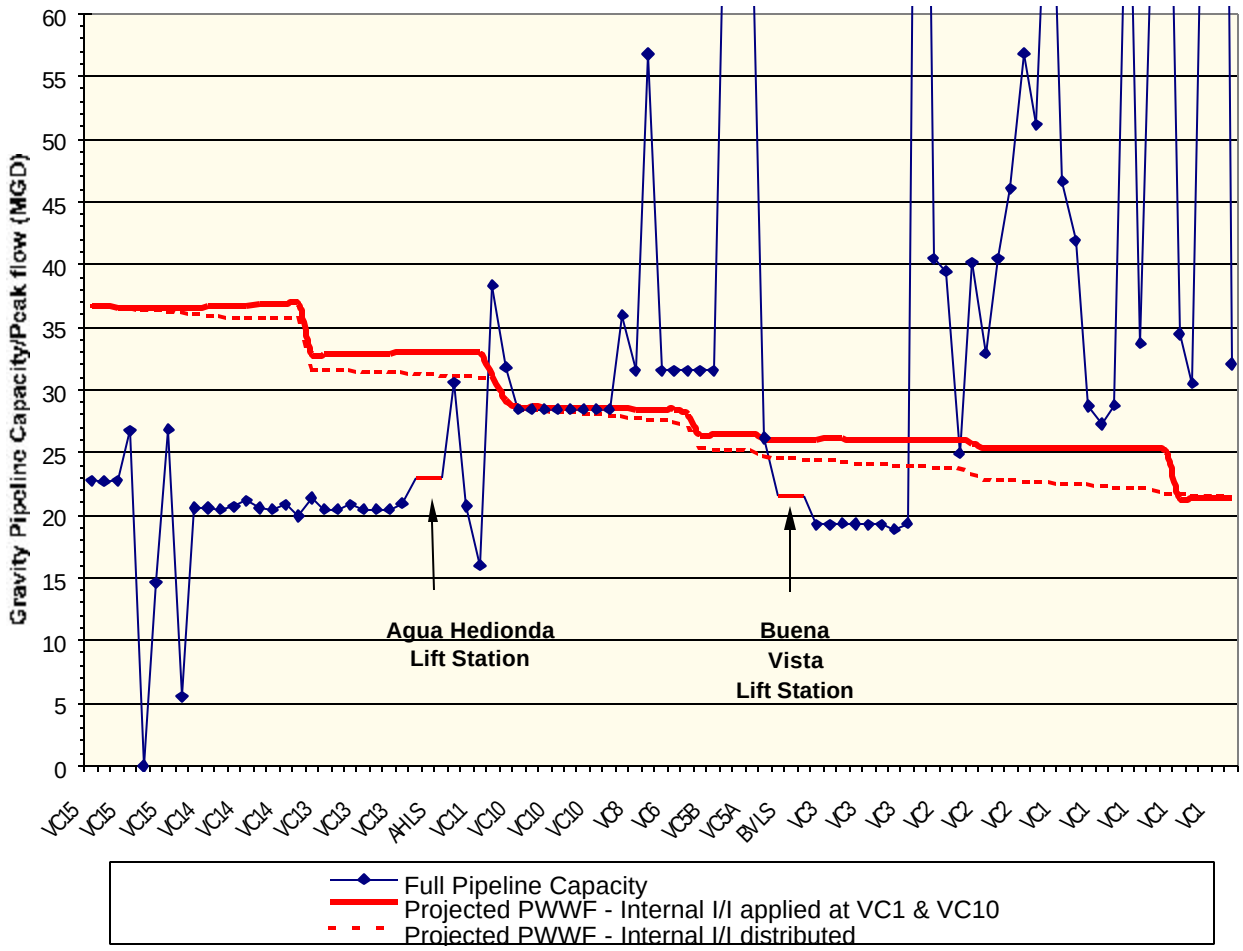
Hydraulic analyses were performed to determine the ability of the interceptors to convey projected peak flows. Analysis of the ultimate interceptor system was accomplished by adding the SAH Interceptor to the existing system model. City of Carlsbad flows were analyzed in the Buena and Vallecitos Interceptors and the peak flows compared to existing capacity rights. Flow analysis results from the SewerCAD ultimate system model are presented graphically for each interceptor system and compared to the gravity pipeline capacities. The graphs illustrate the composite peak flow in each pipeline segment over the course of the 24-hour flow simulation. Flows and capacities are schematically illustrated according to the reach designations shown in Figure 2-1. Where lift stations are included in the interceptor, the lift station name and firm pumping capacity are indicated on the graph.

2.6.1 Vista/Carlsbad Interceptor

Figure 2-7 illustrates results from the PWWF analysis for the V/C Interceptor, and makes a comparison with existing pipeline capacities. For this analysis, a peak I&I rate of 6.1 MGD was added to City of Vista projected peak dry weather flows. The I&I attributed to Carlsbad, 5.6 MGD, was distributed two different ways. One flow scenario distributes the I&I along the length of the V/C Interceptor. The other, more conservative scenario, assigns most of I&I to the upstream Reach V1, with the remainder at the confluence with the NAH Interceptor. As stated previously, it is not known how much I&I is currently contributed by the NAH Interceptor. Although the internal I&I rate in the ultimate system model was increased by 20 percent over the existing I&I rate, it is noted that I&I was not included for the SAH Interceptor. Flows entering the V/C Interceptor at the upstream end of Reach VC14 are therefore based on the projected peak dry weather flow from the SAH Interceptor.

From Figure 2-7, it is apparent that the reaches downstream of VC10, Reach VC3, and the Buena Vista and Agua Hedionda Lift Stations are not adequately sized to convey the projected PWWF. In addition, analysis results indicate that Reach VC10, which is currently under construction as a 48-inch diameter pipeline, may flow full for short periods during severe storm events.

Figure 2-7
V/C INTERCEPTOR PEAK WET WEATHER FLOW



2.6.2 North Agua Hedionda Interceptor

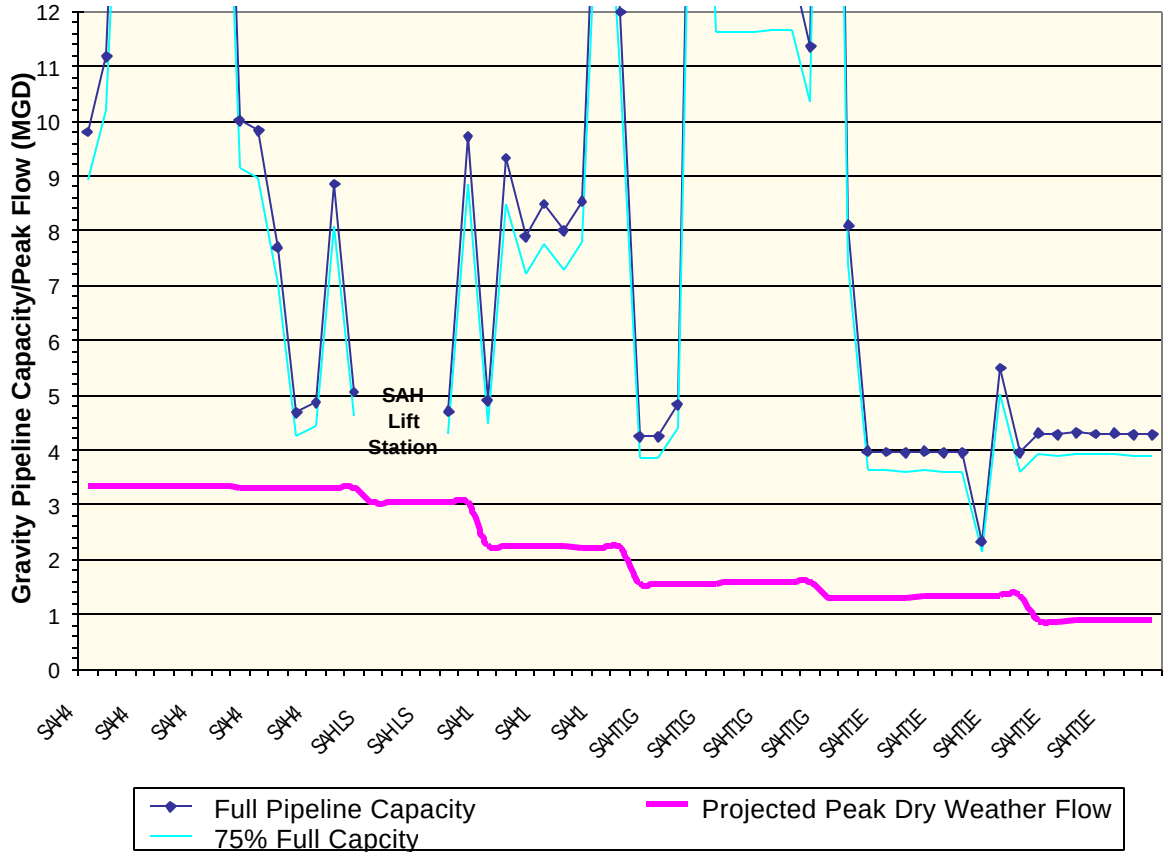
The projected ultimate ADWF for the NAH Interceptor is approximately 1.07 mgd, which is less that the existing ADWF of 1.3 MGD. The capacity of the NAH Interceptor was determined to be sufficient to convey existing flows, with the exception of several short reaches. Therefore, additional analysis of this interceptor system was not performed with ultimate system flows.

2.6.3 South Agua Hedionda Interceptor

The projected ultimate PDWF and design capacity of the SAH Interceptor are illustrated on Figure 2.8. Peak dry weather analysis was performed for the SAH Interceptor since there is no data to estimate peak wet weather flows. The upstream trunk sewer along El Camino Real and Sunny Creek Road (SAHT1E and SAHT1G) is also depicted in Figure 2-8. On the basis of this analysis there should be sufficient

capacity in the gravity interceptor system to convey peak wet weather flows. The PDWF through the SAH Lift Station is projected to be approximately 3.0 MGD, but the lift station capacity will need to be greater to convey stormwater flows.

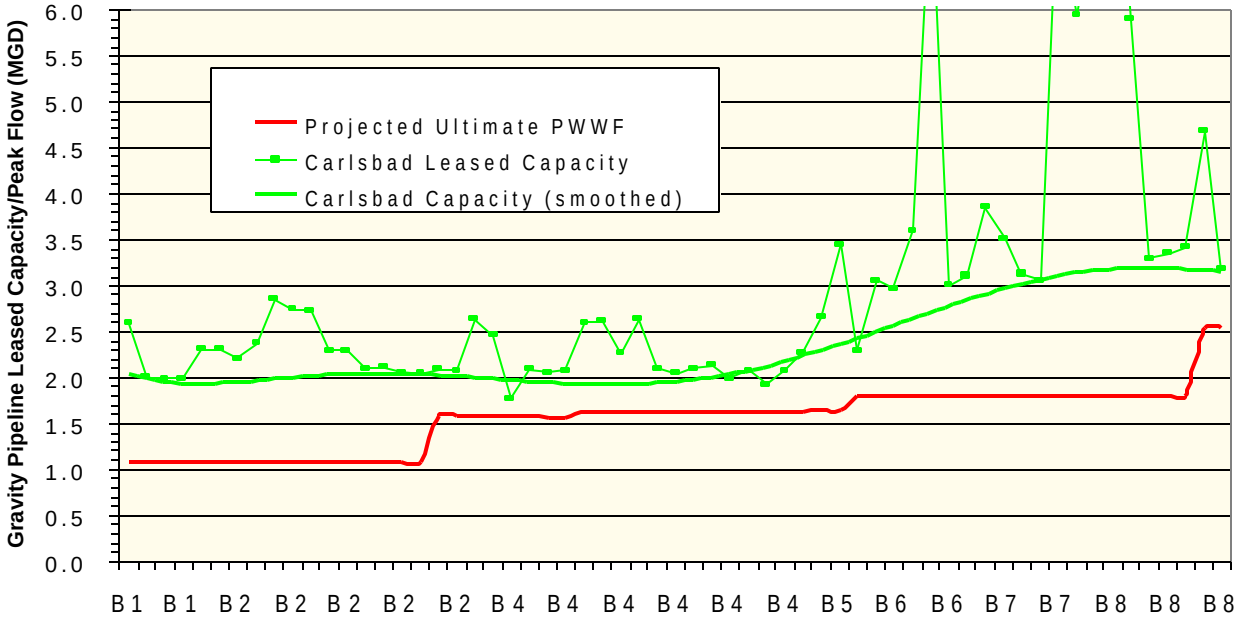
Figure 2-8
SOUTH AGUA HEDIONDA PEAK DRY WEATHER FLOW



2.6.4 Buena Intercepetor

Figure 2-9 illustrates the projected ultimate PWWF generated by the City of Carlsbad in the Buena Interceptor, and makes a comparison with existing capacity rights. As shown on the chart, the current leased capacity is projected to be sufficient to convey ultimate flows.

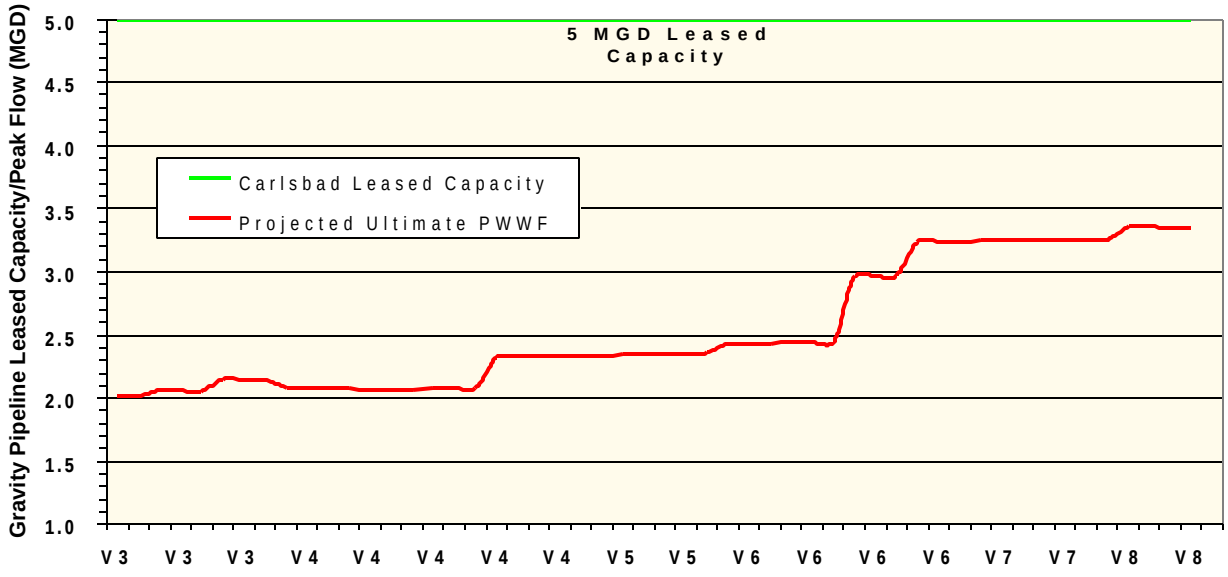
Figure 2-9
PROJECTED CARLSBAD PWWF IN THE BUENA INTERCEPTOR



2.6.5 Vallecitos Interceptor

Figure 2-10 illustrates the projected ultimate PWWF generated by Carlsbad in the Vallecitos Interceptor, and makes a comparison with the existing capacity rights of 5.0 MGD. Although flows to this interceptor are projected to increase by approximately 70 percent, the current leased capacity is projected to be sufficient to convey ultimate flows, as shown on the graph.

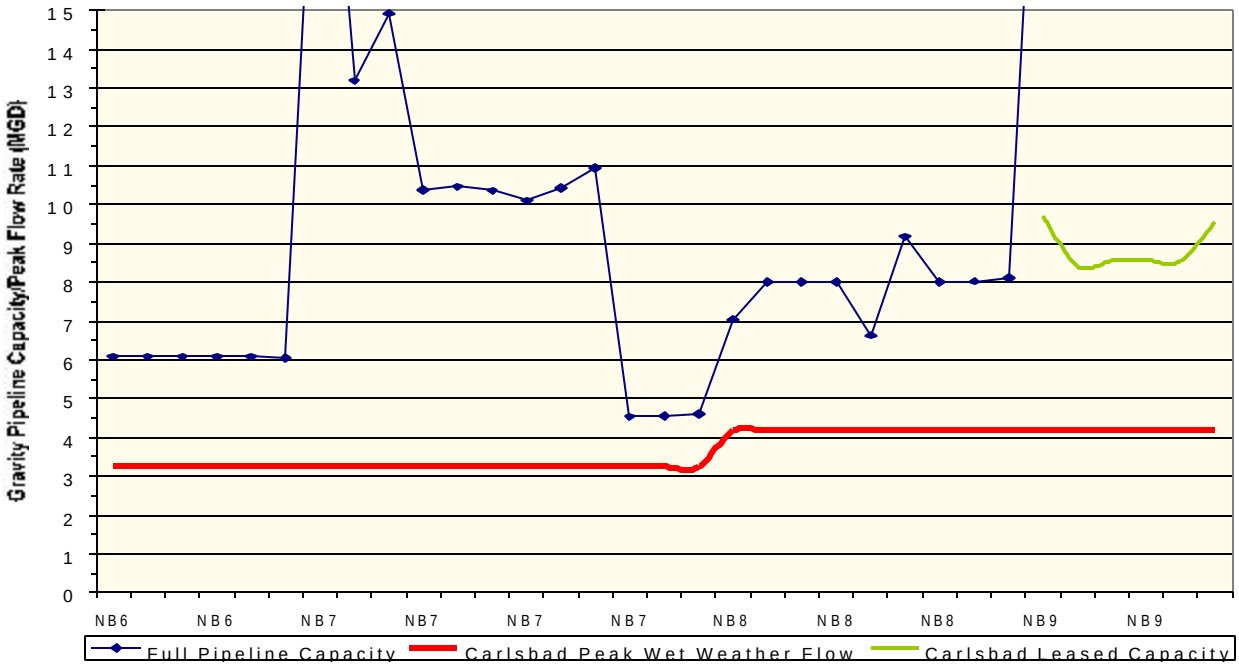
Figure 2-10
PROJECTED CARLSBAD PWWF IN THE VALLECITOS INTERCEPTOR



2.6.6 North Batiquitos Interceptor

The upstream portion of the North Batiquitos Interceptor conveys only City of Carlsbad flows. This portion of the Interceptor was analyzed with the projected PDWF and compared to the design capacity of the gravity pipelines. There is ample capacity in the upstream gravity pipelines to convey the projected ultimate flows. The North Batiquitos Interceptor downstream of the lift station was analyzed with both fixed-speed pumps in operation. City of Carlsbad flows in this portion of the Interceptor are shown on Figure 2-11, together with the full gravity pipeline capacities and leased capacity in the Occidental Sewer. Based on this analysis, the existing leased capacity is projected to be approximately 4.0 MGD in excess of what is required to convey projected peak ultimate flows.

Figure 2-11
CARLSBAD PWWF IN THE DOWNSTREAM NORTH BATIQUITOS INTERCEPTOR



2.7 RECOMMENDATIONS

Gravity interceptor replacements for the V/C Interceptor at Reaches VC3, VC11B, and VC13-15 are recommended to increase the capacity based on projected peak flows. The projected PWWF in the V/C Interceptor is shown on Figure 2-12, together with the capacity of the existing pipeline reaches and the recommended pipeline capacities. The design capacity of the new pipelines is calculated based on the average slope of the existing reach and a Manning's coefficient ("η") of 0.012, assuming that the future pipe will be PVC-lined.

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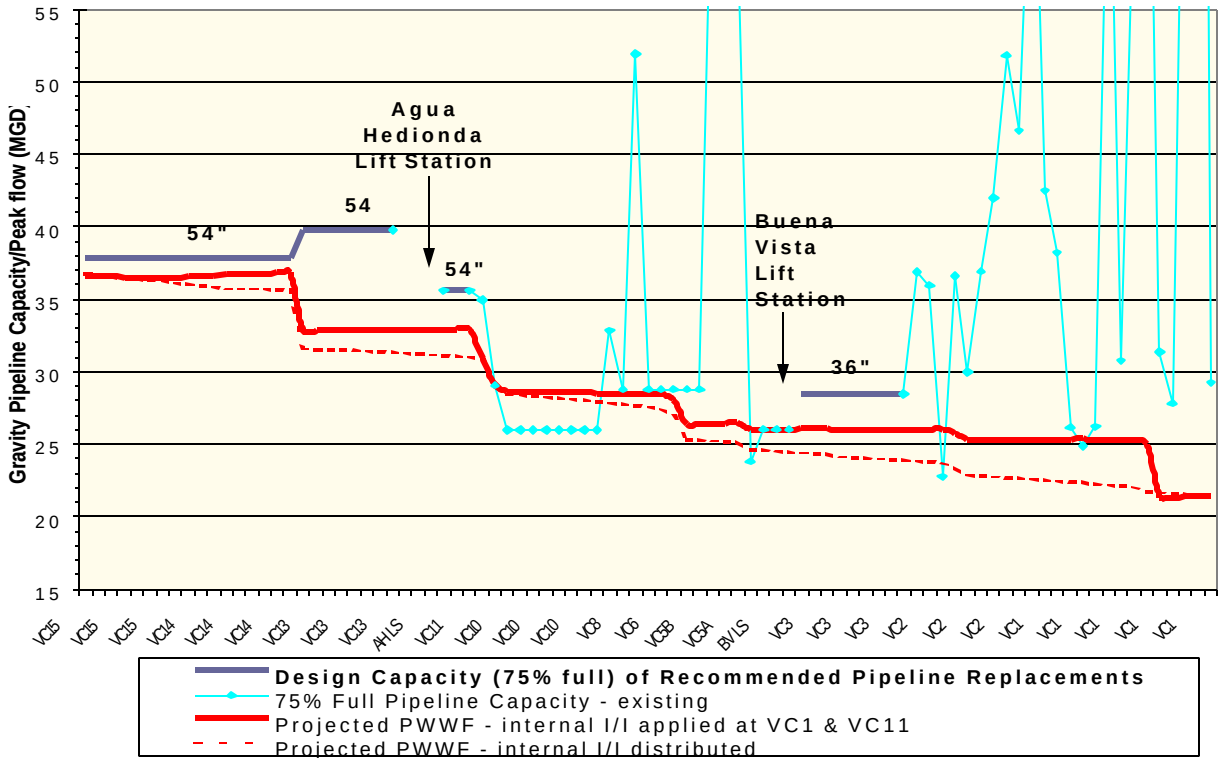
Figure 2-12
V/C INTERCEPTOR CAPACITY WITH RECOMMENDED IMPROVEMENTS



In addition to the gravity pipeline replacement projects, capacity improvements are recommended for the Buena Vista Lift Station and force main and the Agua Hedionda Lift Station and force main. Pumping units were last replaced at the Buena Vista Lift Station in 1994. The reported firm capacity of the lift station is 14,000 gpm, and the projected ultimate PWWF at the station is approximately 18,000 gpm. The capacity of the Buena Vista Lift Station has never been confirmed due to existing downstream capacity limitations. Because of the long length of the force main (approximately 4,000 feet) and high pipeline velocities with projected ultimate flows, it may be possible to obtain the required increase in station capacity with the existing pumps and a larger forcemain. It is recommended that a new 24-inch diameter force main replace the 16-inch main and parallel the existing 24-inch main for its entire length. In addition to increasing the station capacity, the new parallel force main will reduce peak velocities and increase reliability

It is recommended that the capacity of the Agua Hedionda Lift Station be increased to a minimum of 33 MGD (23,000 gpm), which is the projected PWWF through the station. A larger force main will be required at the station. There are several deficiencies with the existing Agua Hedionda Lift station, including an undersized wet well, lack of full operational redundancy, insufficient space around the pumping units, and problems related to the age and general condition of the station. *A Preliminary*

Design Report for Agua Hedionda Lift Station Upgrade, dated March 7, 2000 was prepared for the City. The recommendations from that report include replacement of the existing lift station with the exception of the emergency generator building.

Most of the South Agua Hedionda Interceptor has been constructed. The remaining portions of the SAH Interceptor yet to be installed are the SAH Lift Station and forcemain. The recommended capacity of the SAH Lift Station is 4.2 MGD (2,900 gpm). The recommended 14-inch diameter force main will have an approximate length of 5,380 feet and be constructed in the future alignment of Cannon Road. A gravity sewer will be constructed with the forcemain that will connect with a gravity line in Faraday Road and convey flows from the Faraday Business Park and to the SAH Lift Station. After completion of these projects, the two Faraday Lift Stations and the Kelly Lift Station will be removed.

The District shares ownership or leases capacity in several facilities with the City of Vista, the Buena Sanitation District, the Vallecitos Water District, the Leucadia County Water District and Encinitas Sanitary Division of the City of Encinitas. These facilities include the V/C Interceptor, the Buena Interceptor, the Vallecitos Interceptor and the Occidental Sewer. The following discussions provide an overview of these facilities relative to projected ultimate wastewater flow conditions.

Vista/Carlsbad Interceptor. The Vista/Carlsbad Interceptor ownership percentages and capacity rights from the 2001 draft agreement with the City of Vista are provided in Table 3-1 of this report. Based on the agreement, Carlsbad has a 43.9% ownership in the downstream reach of the V/C Interceptor (VC15). Projected flows for Carlsbad are now lower, and the percentage of flow for Carlsbad in this reach is now estimated at 37.2%. It is recommended that a new agreement be negotiated based on the updated flow projections in this Master Plan Update.

Buena Interceptor. The City of Carlsbad leases capacity in the Buena Interceptor. The existing lease agreement was last modified in 1987 to lease an additional 0.8 MGD of capacity. It is estimated that Carlsbad will not require any additional capacity in this interceptor to convey projected ultimate flows. It is noted that the existing Buena Interceptor does not have the capacity to convey buildout flows based on ultimate flow projections for the BSD and the City of Vista Raceway Basin. The City of Vista includes a project in their 2001 Master Plan to construct a new force main from the Buena and Raceway Lift Stations to the Vallecitos Interceptor.

Vallecitos Interceptor. The City of Carlsbad currently leases 5.0 MGD of capacity in the Vallecitos Interceptor. City of Carlsbad ultimate peak flows in this interceptor are projected to be less than 3.5 MGD. The existing interceptor does not have the capacity to convey buildout flows for the VWD and future flows from the BSD and the City of Vista Raceway Basin. The VWD plans to replace the existing Vallecitos Interceptor with a larger capacity interceptor. Based on projected ultimate flows, Carlsbad could reduce their leased capacity to approximately 4.0 MGD.

Occidental Sewer. The Occidental Sewer is jointly owned by the City of Carlsbad, the ESD and the LCWD. Carlsbad's current ownership capacity, which is estimated to be approximately 8.5 MGD, is projected to be approximately 4.0 MGD in excess of what is required to convey the ultimate PWWF. The LCWD projects that they will need to acquire an additional 1.6 MGD of conveyance capacity in the Occidental Sewer in their most recent Master Plan. It is recommended that the ownership capacities defined in the 1972 Occidental Pipeline Agreement be updated based on current flow projections.

2.8 CAPITAL IMPROVEMENT PROGRAM

Improvement projects identified for the Capital Improvement Program (CIP) are summarized in Table 2-6. The projects are arranged into three groups. The first group of projects includes improvements to the sewer collector system and rehabilitation projects. These projects were updated from the City's 2002-2003 CIP based on discussions with City staff. The next group consists of interceptor capacity projects, which were identified from the hydraulic analysis performed as part of this Master Plan Update. The last group of projects are for improvements at the Encina Water Pollution Control Facility, which were also defined in the City's 2002-2003 CIP.

Table 2-6 includes a planning level estimate of probable construction costs. Costs should be considered relative to the 2002 Engineering News Record Construction Cost Index (ENR CCI) of 6538. Cost estimates for the Encina WPCF projects and most of the collector system projects were obtained from the City's 2002-2003 CIP. It is noted that costs identified for V/C Interceptor capacity improvements represent the total cost, although a portion of these costs will be shared by the City of Vista. The costs for the Encina WPCF projects represent the City's pro-rated share for the projects.

Table 2- 6
RECOMMENDED SEWER CAPITAL IMPROVEMENT PROGRAM

Project ID	Description/Location	Project Type	Size/Quantity	Probable Constr. Cost
COLLECTOR SYSTEM & REHABILITATION PROJECTS:				
1	Avenida Encinas Gravity Sewer - new sewer along north side of Lanakai Mobil Home Park to reduce odors	new gravity sewer	1000' of 8" pipeline	$ 175,000
2	North Agua Hedionda Interceptor Rehabilitation - West Segment (Cove Dr. to Hoover St.) - rehab manholes, new access road, erosion protection, minor sewer realignment, EIR, construct mitigation site	rehab manholes, new access road, sewer realignment	19 manholes 700' of 24" pipeline	$ 3,629,000
3	North Agua Hedionda Interceptor Rehabilitation - East Segment (ECR to Kelly Dr.) - replace/rehabilitate manholes	rehab/replace manholes	21 manholes	$ 620,000
4	North Agua Hedionda Trunk Sewer Replacement (Reach NAHT1A)- Tamarack Av. from ECR to Calavera Hills Treatment Plant	replace FM with gravity sewer	5000' of 8" pipeline	$ 1,533,000
5	North Batiquitos Interceptor Rehabilitation - MH Rehab & new access road from ECR west to NB Lift Station	access road & MH rehab	---	$ 1,000,000
6	El Camino Sewer - Construct gravity sewer in ECR from Chestnut Av. To Tamarack Av.	new gravity sewer	4200' of 8" pipeline	$ 420,000
7	Sewer Lift Stations Repairs/Upgrades - Terramar, Villas and Gateshead Lift Stations	Lift Station Upgrades	---	$ 235,000
8	Remove Forest Lift Station and construct gravity sewer using microtunelling construction	new gravity sewer	1400' of 8" pipeline	$ 800,000
9	Home Plant Lift Station - replace pumps, upgrade wetwell, manifold piping, ventilation system, and reconstruct influent gravity sewer	L.S. Improvements & gravity sewer	260' of 15" pipeline	$ 585,000
10	Remove LCWD La Costa Meadows Lift Station and construct gravity sewer	new gravity sewer	600' of 8" pipeline	$ 175,000
11	Remove La Golondrina Lift Station and construct gravity sewer	new gravity sewer	1000' of 8" pipeline	$ 150,000
12	Poinsettia Lift Station Odor and Noise Abatement	L.S. rehab	---	$ 221,800
13	Sewer Line Refurbishment/Replacement - replace or refurbish sewer lines older than 30 years	replace/refurbish gravity sewers	---	$ 7,868,000
14	Vista/Carlsbad Interceptor Rehabilitation Reaches VC1 and VC2 - line pipelines and rehab manholes	line sewers & rehab manholes	9,430' of 36" pipeline 25 manholes	$ 377,000

continued next page

Table 2- 6 *(continued)*

Project ID	Description/Location	Project Type	Size/Quantity	Probable Constr. Cost
COLLECTOR SYSTEM & REHABILITATION PROJECTS *(continued)* :				
15	Gateshead Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	200' of 8" pipeline	$ 60,000
16	Vancouver Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	300' of 8" pipeline	$ 60,000
17	Simsbury Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	500' of 8" pipeline	$ 100,000
18	Villas Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	2000' of 8" pipeline	$ 270,000
19	Woodstock Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	400' of 8" pipeline	$ 80,000
20	Faraday #14 (Upper) Lift Station - remove station & connect to existing gravity sewer	L.S. replacement with gravity sewer	---	$ 30,000
21	Faraday #10 (Lower) Lift Station - remove station & connect to existing gravity sewer	L.S. replacement with gravity sewer	---	$ 30,000
22	North Batiquitos L.S. Modifications- new gas detectors, ventilation system, odor control, improved pump access, wiring, & float switch	L.S. rehab	---	$ 500,000
23	Carlsbad Trunk Sewer Reaches VCT1A, VCT1B, VCT1C - Convey flows from Vancouver and Simsbury Lift Station service areas through LFMZ25 to the V/C Interceptor (see related projects 16 & 17)	new gravity sewer	2000' of 8" pipeline	$ 150,000
24	Master Plan Update - update of sewer MP and CEQA approval	prepare reports	--	$ 305,000
25	Sewer Monitoring Program - monitor sewer flows in pipelines and at lift stations	monitor flows	--	$ 600,000
26	Sewer Access Hole Rehabilitation - replace or refurbish manholes older than 30 years	rehab/replace manholes	--	$ 2,800,000
27	Sewer Connection Fee Update	prepare report	--	$ 15,000
			Collector System & Rehabilitation Projects Subtotal	**$ 22,789,000**

continued next page

Table 2- 6 *(continued)*

Project ID	Description/Location	Project Type	Size/Quantity	Probable Constr. Cost
INTERCEPTOR CAPACITY PROJECTS:				
28	Vista/Carlsbad Interceptor Reach VC3 - capacity upgrade upstream of the Buena Vista Lift Station	interceptor replacement	3,350' of 42" pipeline	$ 2,570,000*
29	Buena Vista Lift Station - capacity increase, control system upgrade, new back-up generator	L.S. rehab	Lift Station capacity = 26 MGD	$ 735,000*
30	Buena Vista Lift Station Force Main (VC4) - replace existing 16" pipeline with 24" pipeline to provide dual 24" FMs & increase capacity	new force main	3,840' of 24" force main	$ 1,244,000*
31	Vista/Carlsbad Interceptor Reach VC11B - upgrade capacity and construct new bridge crossing over the Agua Hedionda Lagoon	interceptor replace-ment & new bridge	915' of 54" pipeline	$ 2,900,000*
32	Agua Hedionda Lift Station and Force Main VC12 - rehab lift station and construct new force main	L.S. rehab & new force main	Lift station capacity = 36 MGD 200' of 36" force main	$ 6,250,000*
33	V/C Interceptor Reaches VC13, VC14 & VC15 - Increase interceptor capacity from the AH Lift Station to Encina WPCF	interceptor replacement	3510' of 54" pipeline 6,831' of 60" pipeline	$ 10,200,000*
34	South Agua Hedionda Lift Station and Force Main - construct lift station, force main and gravity sewer in Cannon Rd., remove Kelly Lift Station	New L.S., FM & gravity sewer	Lift Station capacity = 4.2 MGD 5,380' of 14" force main 2,568' of 12" gravity pipeline	$ 8,827,000
			Interceptor Capacity Projects Subtotal	**$ 32,726,000**
ENCINA WATER POLLUTION CONTROL FACILITY PROJECTS:				
35	Encina WPCF Building Improvements	improve building	---	$ 1,787,000
36	Capital Acquisitions - Unit 1	acquisitions	---	$ 3,415,000
37	Capital Planning/Services	planning	---	$ 1,910,000
38	Cogeneration Project - upgrade of the electrical generators	facility upgrade	---	$ 581,000
39	Flow Equalization Project - construct tank for peak effluent flows	construct tank	---	$ 8,189,000
40	Phase IV Expansion - Debt Service on Phase IV plant expansion	debt service	---	$ 13,082,000
41	Phase V Expansion - expand plant capacity for buildout conditions	TP expansion	---	$ 11,693,000
42	Phase V Expansion - Interim capacity improvements	TP expansion	---	$ 222,000
43	Plant Rehabilitation	machinery rehab	---	$ 2,909,000
44	Pump Station Interfaces - develop active flow monitoring system	report	---	$ 60,000
45	Technology Master Plan	report	---	$ 1,161,000
			Encina WPCF Projects Subtotal	**$ 45,009,000**
			CAPITAL IMPROVEMENT PROJECT TOTAL =	**$ 100,524,000**

* Costs for V/C Interceptor capacity improvememnts includes Vista's share of

CHAPTER 3
EXISTING SYSTEM DESCRIPTION

This chapter summarizes the existing wastewater facilities within the City of Carlsbad Sewer Service Area. These facilities include the main sewer interceptors, lift stations, and wastewater treatment and disposal facilities. Information regarding the existing wastewater collection system facilities was derived from the District's sewer atlas books, as-built construction drawings, previous reports and studies, and City Engineering and Public Works staff input. Capacity calculations for the gravity interceptors are based on the sewer system GIS and were generated using the SewerCAD hydraulic model.

3.1 GENERAL

The City of Carlsbad Sewer Service Area includes the majority of the City, with the exception of the southeast corner of the City. Wastewater collection in the southeastern area is provided by the Vallecitos Water District (VWD) and the Leucadia County Water District (LCWD). Carlsbad's Sewer Service Area extends from the Pacific Coast approximately 5 miles inland, providing wastewater collection, treatment and disposal service to customers within its 30 square mile service area. The service area is characterized by gently rolling to highly dissected mesa-like hills, commonly topped by remnants of marine terraces. Elevations range from sea level along the coast to over 600 feet along the eastern boundary.

The proximity of the Pacific Ocean is a major influence on coastal Southern California weather. Early morning and late evening fog in fall and late spring; dry, warm summers; and cool to moderate winters are typical of the subtropic climate experienced in northern San Diego County. The temperature range increases with distance inland from the coast, with an average annual temperature in the low to mid 60 degrees Fahrenheit (°F) at the coast and in the inland valleys. The mean temperature range for the City of Carlsbad is typically between 55°F in January to approximately 70°F in August. The average annual precipitation is 10.7 inches and most of the rainfall occurs between November and March.

3.2 INTERCEPTOR SYSTEM

At ultimate development, there will be five major interceptors within the City of Carlsbad Sewer Service Area. Four of the interceptor systems have been constructed and are now in use. The alignments and reach designations of the existing interceptor sewers are shown on Figure 3-1 and also on the figures included in the following sub-sections for each individual interceptor system. The naming convention for the interceptor reaches was developed in previous master plans.

OCEANSIDE

VISTA/CARLSBAD

OCEANSIDE

NORTH AGUA HEDIONDA

VISTA

BUENA

VALLECITOS

SAN MARCOS

NORTH BATIQUITOS

VC1 VC2 VC3 VC4 VC5A VC5B VC6 VC7 VC8 VC9 VC10 VC11 VC12 VC13 VC14 VC15

NAH1 NAH1B NAH2 NAH3 NAH4 NAH5 NAH6 NAH7

B1 B2 B4 B5 B6 B7 B8 V3 V4 V5 V6 V7 V8

NB1 NB2 NB3 NB4 NB5 NB6 NBT3B NB7 NB8 NB9 NB10

MARRON ROAD

BUENA VISTA LAGOON

LAKE CALAVERA

VILLAGE DRIVE

CARLSBAD TAMARACK AVENUE

CARLSBAD BOULEVARD

AGUA HEDIONDA LAGOON

CANNON ROAD

COLLEGE BOULEVARD

PALOMAR AIRPORT ROAD

POINSETTIA LANE

ALGA ROAD

EL CAMINO REAL

LA COSTA BOULEVARD

AVIARA PARKWAY

BATIQUITOS LAGOON

5

LEGEND

SEWER SERVICE AREA BOUNDARY

SEWER INTERCEPTOR SYSTEM

GRAVITY SEWER

FORCEMAIN

SIPHON

N

1"=4000'

FIGURE 3-1

CITY OF CARLSBAD
EXISTING INTERCEPTOR SYSTEM

DUDEK & ASSOCIATES, INC.
Professional Teams for Complex Projects

3.2.1 Vista/Carlsbad Interceptor

The Vista/Carlsbad (V/C) Interceptor is jointly owned by the City of Vista and the City of Carlsbad. The V/C Interceptor is approximately eight miles long, and extends from the Vista meter station just west of College Boulevard and Highway 78 to the Encina WPCF. Flow from the City of Vista and a small portion of the City of Oceanside is metered at the upstream reach. The Buena Vista Lift Station and Agua Hedionda Lift Station, both of which are maintained and operated by the Encina Wastewater Authority, are a part of the interceptor system. Flow from the North Agua Hedionda Interceptor enters the V/C Interceptor just upstream of the Agua Hedionda Lift Station. In addition, flow from a portion of the existing South Agua Hedionda Interceptor enters the V/C Interceptor at Cannon Road, just downstream of the Agua Hedionda Lift Station.

The V/C Interceptor was originally constructed in 1965. Sections of the interceptor were replaced with larger diameter pipelines in 1979 and 1987, and the replacement of a two-mile section of 24- and 36-inch diameter pipeline through the downtown Carlsbad area is currently under construction. For the purposes of this Master Plan, the 2001-2002 Vista/Carlsbad Sewer Replacement Project is considered to be a part of the existing sewer system and has been included in the exiting system sewer model as currently designed.

The existing V/C Interceptor includes gravity pipelines ranging from 30 to 48 inches in diameter, parallel 18-inch force mains at the Agua Hedionda Lift Station, and parallel 24 and 16-inch diameter force mains at the Buena Vista Lift Station. Most of the gravity pipelines are vitrified clay pipe (VCP), ductile iron pipe (DIP), or reinforced concrete pipe (RCP) with a PVC liner (T-Lock liner). Approximately 3,500 linear feet of pipeline was constructed in Jefferson Street and Oak Avenue in 2002 using microtunneling technology to install 42-inch diameter sections of centrifugally cast fiberglass reinforced plastic mortar (CCFRPM) pipe. The pipe material for this section is listed by the trade name “Hobas” on the construction drawings. The existing V/C Interceptor serves all or portions of the Local Facility Management Zones (LFMZ) 1, 2, 3, 13, and 22, and also collects flow from the NAH Interceptor. Ultimately the V/C Interceptor will serve LFMZ 25 and portions of LFMZ 7, and collect flows from the future South Agua Hedionda (SAH) Interceptor.

The agreement for Ownership, Operation, and Maintenance of the V/C Interceptor Sewer was revised in February 2002 and is provided in Appendix B. Carlsbad’s ownership rights in the interceptor are based on the full flow pipeline capacity and increase in the direction of flow, reaching approximately 50 percent ownership in the downstream reaches. The V/C Interceptor ownership, based on build-out conditions as defined in the February 2002 Agreement with Vista, is shown in Table 3-1. Figure 3-2 illustrates the reach designations of the V/C Interceptor.

Table 3-1
Vista/Carlsbad Interceptor Ownership
(from February 2002 Agreement with the City of Vista)

Pipeline Reach	Pipe Size (inches)	Full Flow Pipe Capacity (MGD)	City of Vista			City of Carlsbad		
			Average Flow (MGD)	Percent Capacity	Capacity Rights (MGD)	Average Flow (MGD)	Percent Capacity	Capacity Rights (MGD)
VC1	36	30.0	10.38	100.0%	30.0	0.00	0.0%	0.0
VC2	42	34.0	10.38	93.4%	31.8	0.73	6.6%	2.2
VC3	36	19.5	10.38	89.6%	17.5	1.20	10.4%	2.0
Buean Vista Lift Station	--	23.1	10.38	89.6%	20.7	1.20	10.4%	2.4
VC4-FM	24	23.1	10.38	89.6%	20.7	1.20	10.4%	2.4
VC5	42	31.5	10.38	89.6%	28.2	1.20	10.4%	3.3
VC6	42	31.5	10.38	81.9%	25.8	2.29	18.1%	5.7
VC7	42	31.5	10.38	79.4%	25.0	2.69	20.6%	6.5
VC8	42	31.5	10.38	79.4%	25.0	2.69	20.6%	6.5
VC9	48	28.5	10.38	75.5%	21.5	3.37	24.5%	7.0
VC10	48	28.5	10.38	74.7%	21.3	3.51	25.3%	7.2
VC11	42	20.5	10.38	69.1%	14.2	4.65	30.9%	6.3
Agua Hedionda Lift Station	--	23.0	10.38	69.1%	15.9	4.65	30.9%	7.1
VC12-FM	2-18	23.0	10.38	69.1%	15.9	4.65	30.9%	7.1
VC13	42	20.5	10.38	69.1%	14.1	4.65	30.9%	6.4
VC14	42	20.5	10.38	56.1%	11.5	8.11	43.9%	9.0
VC15	42	22.8	10.38	56.1%	12.8	8.13	43.9%	10.0
VC16	54	67.4	10.38	50.2%	33.8	10.28	49.8%	33.6

It is noted that each pipeline "reach", as defined in the Vista/Carlsbad interceptor ownership documented in Table 3-1, actually consists of multiple pipeline reaches which may have varying capacities. As part of the development of the City of Carlsbad GIS, physical information on the V/C Interceptor was obtained from as-built drawings and construction plans. Slopes for each gravity pipeline were calculated from the length between manholes and the pipeline inverts. The full pipe capacity was calculated from the sewer hydraulic model based on a Manning's coefficient ("η") of 0.013 for unlined sections, and a coefficient of 0.012 for the PVC-lined RCP and CCFRPM pipe sections (reaches VC5 through VC10).

The full flow capacity of each pipeline section based on construction drawing data is illustrated on Figure 3-3. Also shown on the chart are the firm capacities of the Buena Vista and Agua Hedionda Lift Stations as reported by Encina Operations Staff (firm capacity is defined as the capacity of installed pump facilities with the largest unit out of service) and the "average" reach capacities listed in Table 3-1.

Figure 3-2
VISTA/CARLSBAD INTERCEPTOR

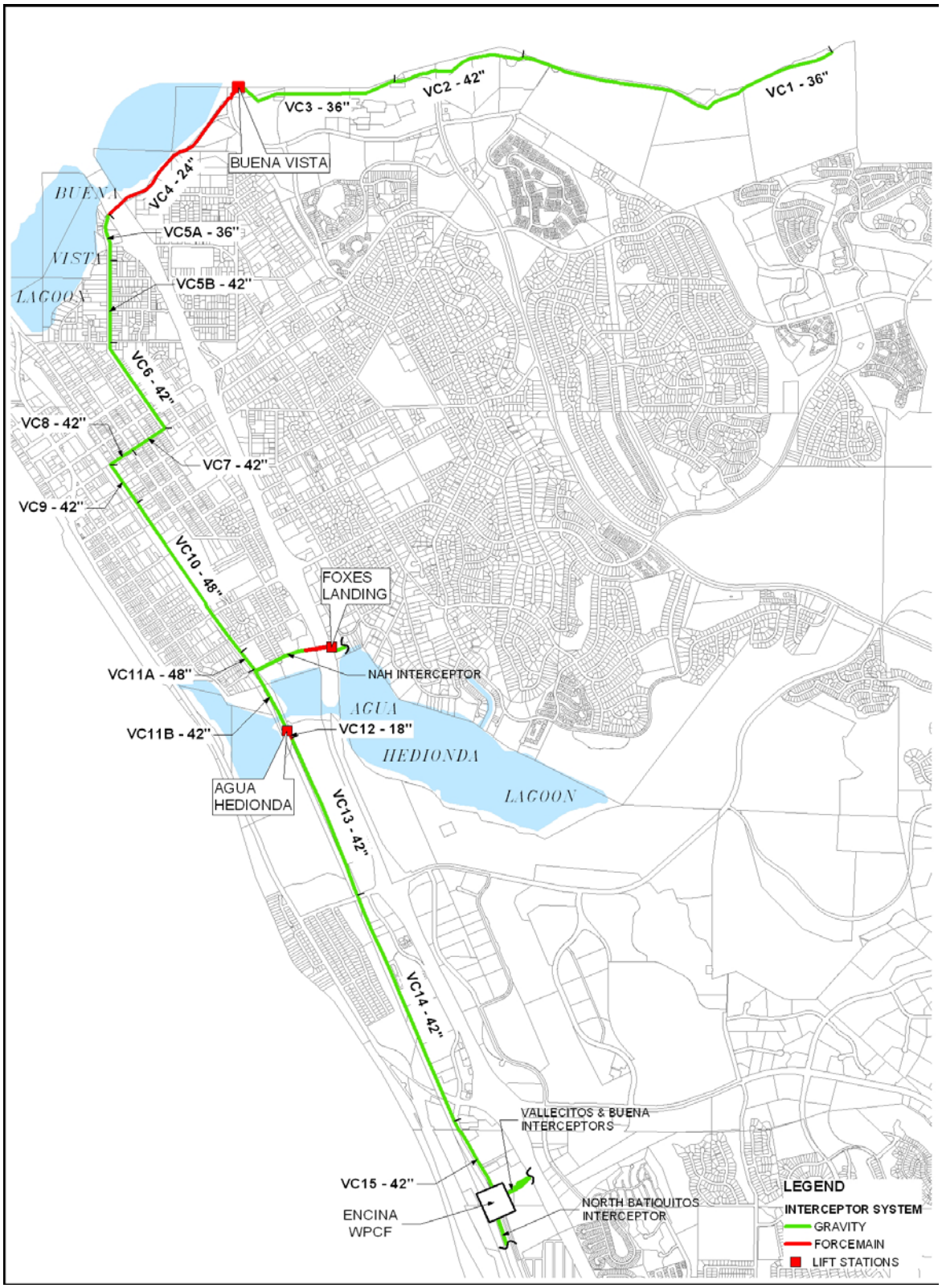
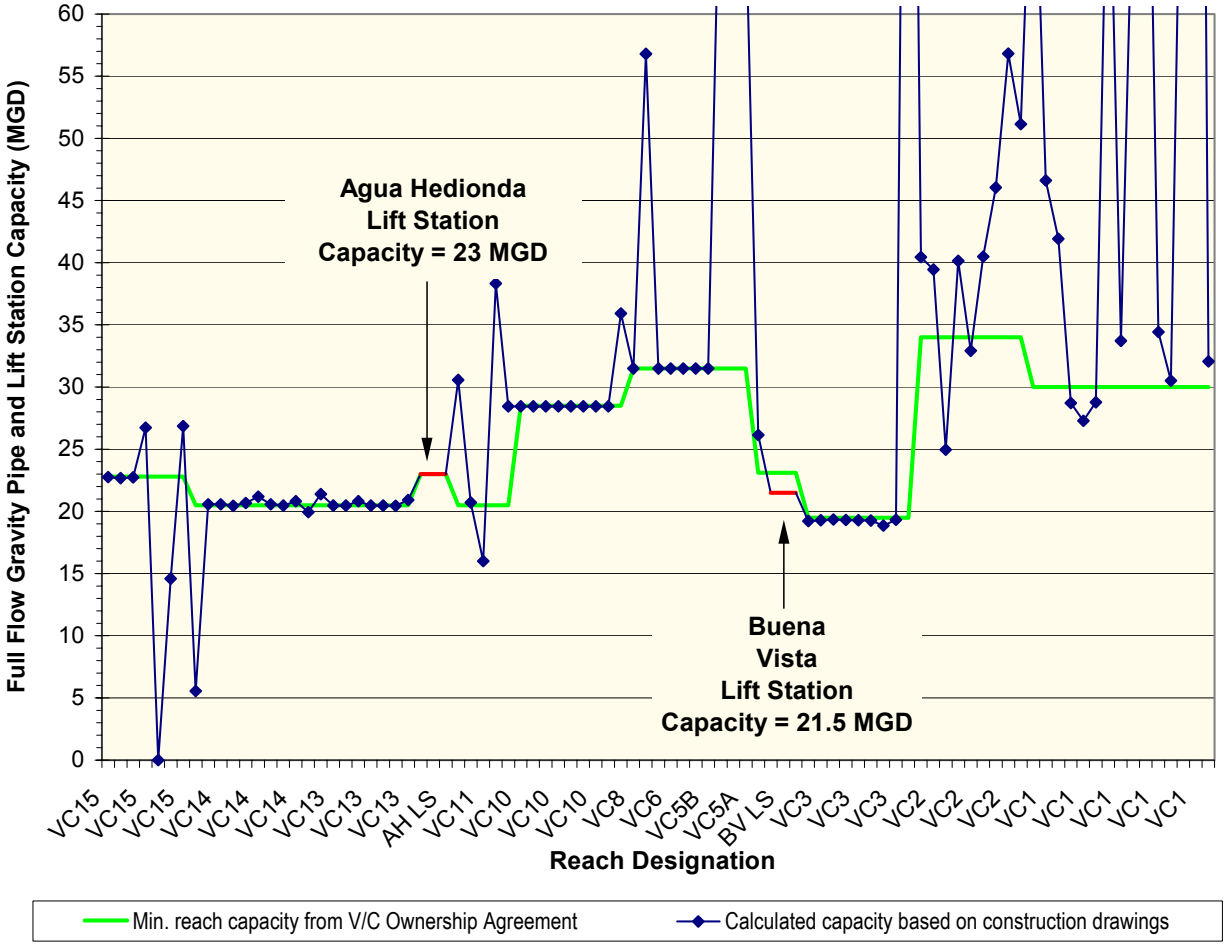


Figure 3-3
FULL PIPE CAPACITY OF THE VISTA/CARLSBAD INTERCEPTOR SYSTEM



It is noted that portions of the upstream reaches of the V/C Interceptor have very steep slopes, and the pipeline capacities at several locations are nearly 100 MGD, which is off the scale of the chart. As can be seen from Figure 3-2, there are several areas where the capacity of individual pipelines in the V/C Interceptor as calculated from the construction drawings are less than the reported capacity documented in Table 3-1. Most notably, there is a very flat 400-ft segment in VC14 with a slope of less than 0.01 percent that is calculated to have a capacity of 5.5 MGD, and a 20-foot segment in VC15 was found to have a slightly negative slope. The pipelines in these two sections currently operate under pressure flow conditions. It is also noted that the capacity of the Buena Vista Lift Station as reported in Table 3-1 is based on the operation of all four pumps.

3.2.2 North Agua Hedionda Interceptor

The North Agua Hedionda (NAH) Interceptor is entirely owned by the City of Carlsbad and conveys only City of Carlsbad wastewater. Beginning at El Camino Real, the interceptor flows westerly along the north shore of the Agua Hedionda Lagoon to just east of Interstate 5. The Foxes Landing Lift Station lifts the wastewater under Interstate 5. The lift station force main discharges into a short gravity interceptor, which flows to the V/C Interceptor upstream of the Agua Hedionda Lift Station.

The NAH Interceptor was constructed in 1966. The hydraulic profile of the interceptor is very flat, and most of the reaches have a slope of less than 0.15 percent. Most of the gravity pipelines are constructed of VCP and the interceptor includes one siphon. The gravity pipelines range in size from 10 to 24 inches in diameter. This interceptor currently serves portions of LFMZs 1, 2, 5, 14, 15 and 24, and all of LFMZs 7 and 8. When the SAH Interceptor and gravity pipelines to the V/C Interceptor through LFMZ 25 are constructed, the NAH Interceptor will serve only portions of LFMZs 1, 2, 7 and 14.

The full pipe capacity of the NAH Interceptor was reported to be between 4.6 and 6.8 MGD in each of the five gravity reaches in the 1992 Master Plan. However, several flatter sections exist which restrict the flow capacity. The HAH Interceptor is illustrated on Figure 3-4 and the full flow and 75 percent full (D/d) pipeline capacities based on available GIS data is shown on Figure 3-5. The firm capacity of the Foxes Lift Station is indicated in red.

Figure 3-4
NORTH AGUA HEDIONDA INTERCEPTOR

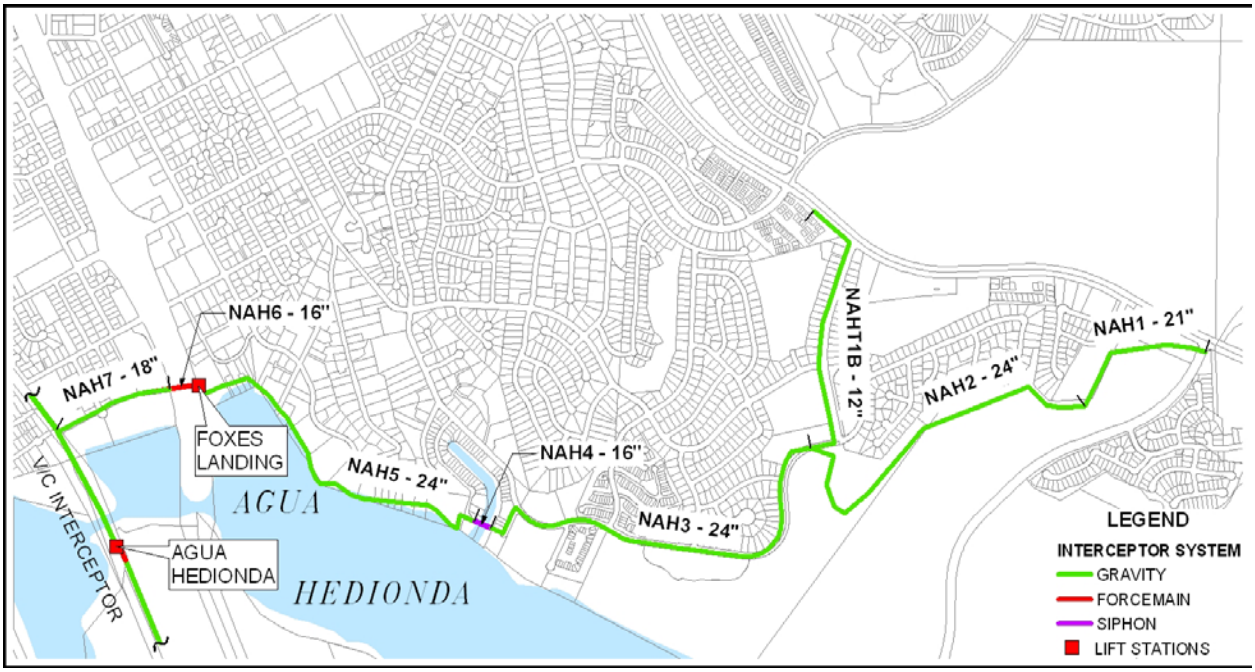
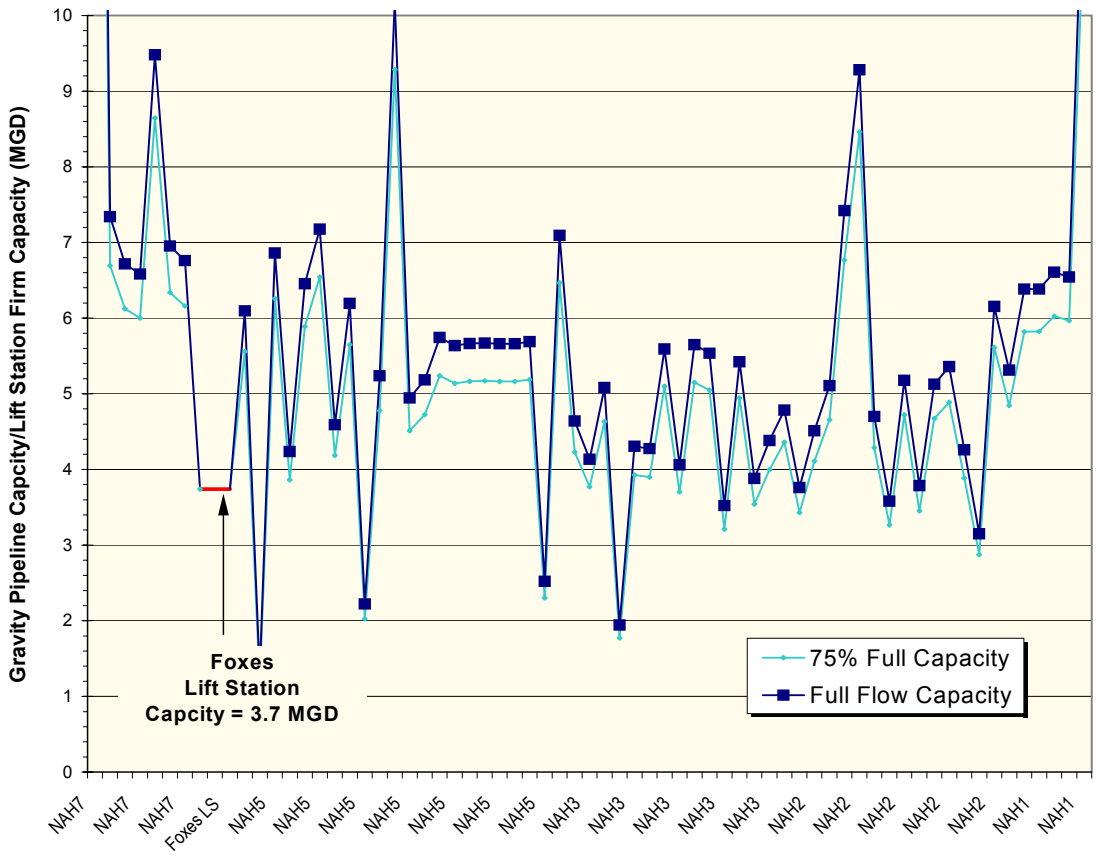


Figure 3-5
CAPACITY OF THE NORTH AGUA HEDIONDA INTERCEPTOR

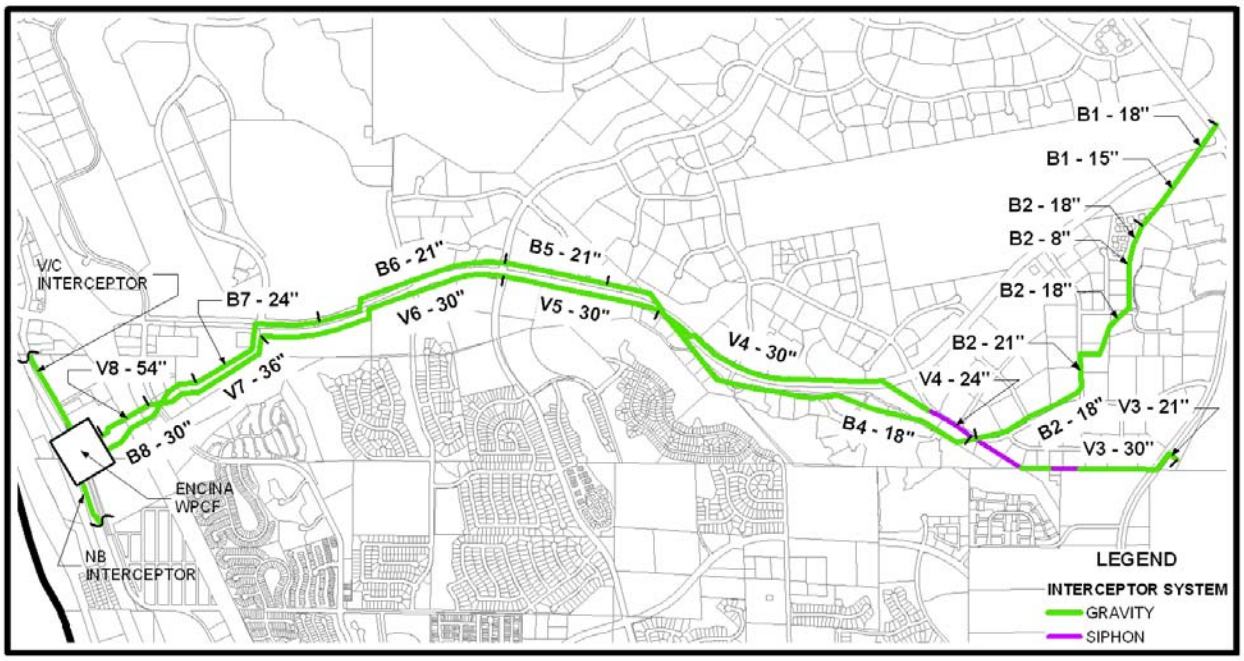


3.2.3 Buena and Vallecitos Interceptors

Two major interceptors follow the Encinas Canyon to the Encina WPCF, the Buena Interceptor and the Vallecitos Interceptor. Both of these interceptors are owned and maintained by other agencies, and the City of Carlsbad has capacity rights based on separate interagency agreements. The interceptors share a single alignment for much of their length, and cross over each other at three separate locations. In the previous Master Plans, the Buena and Vallecitos Interceptors were evaluated as a single interceptor with an equivalent pipeline diameter. In this Master Plan Update, the interceptors are analyzed separately. With the help of City Staff, construction drawings were reviewed for each collector system pipeline that connects to the interceptor systems to determine if flows are currently being discharged to the Vallecitos or Buena Interceptor.

The Buena and the Vallecitos Interceptors are both shown on Figure 3-6. The reach designations assigned to each interceptor were modified from the combined reach designations assigned in the previous Master Plans.

Figure 3-6
BUENA AND VALLECITOS INTERCEPTORS



Buena Interceptor

The first interceptor constructed through the Encinas canyon was the Buena Interceptor, built in 1964. This interceptor was owned by the Buena Sanitation District, which is now a part of the City of Vista. The City of Carlsbad leases capacity in this pipeline. The Buena Interceptor begins at the corner of El Camino Real and Palomar Airport Road, downstream of the discharge of the Buena Lift Station and the City of Vista's Raceway Lift Station. The interceptor flows through the City of Carlsbad's industrial park and then parallels Palomar Airport Road, crossing under Interstate 5 and continuing to the Encina WPCF. The total length of the interceptor is approximately 4.2 miles.

Minor realignments were made to the Buena Interceptor in 1992. The existing interceptor consists of gravity pipelines ranging from 15 to 30 inches in diameter. There are no lift stations or siphons along the alignment. Most of the gravity pipelines are constructed of VCP or reinforced concrete pipe (RCP). The Buena Interceptor currently serves portions of LFMZs 3, 4, 5 and 20. The ultimate service area is anticipated to remain the same.

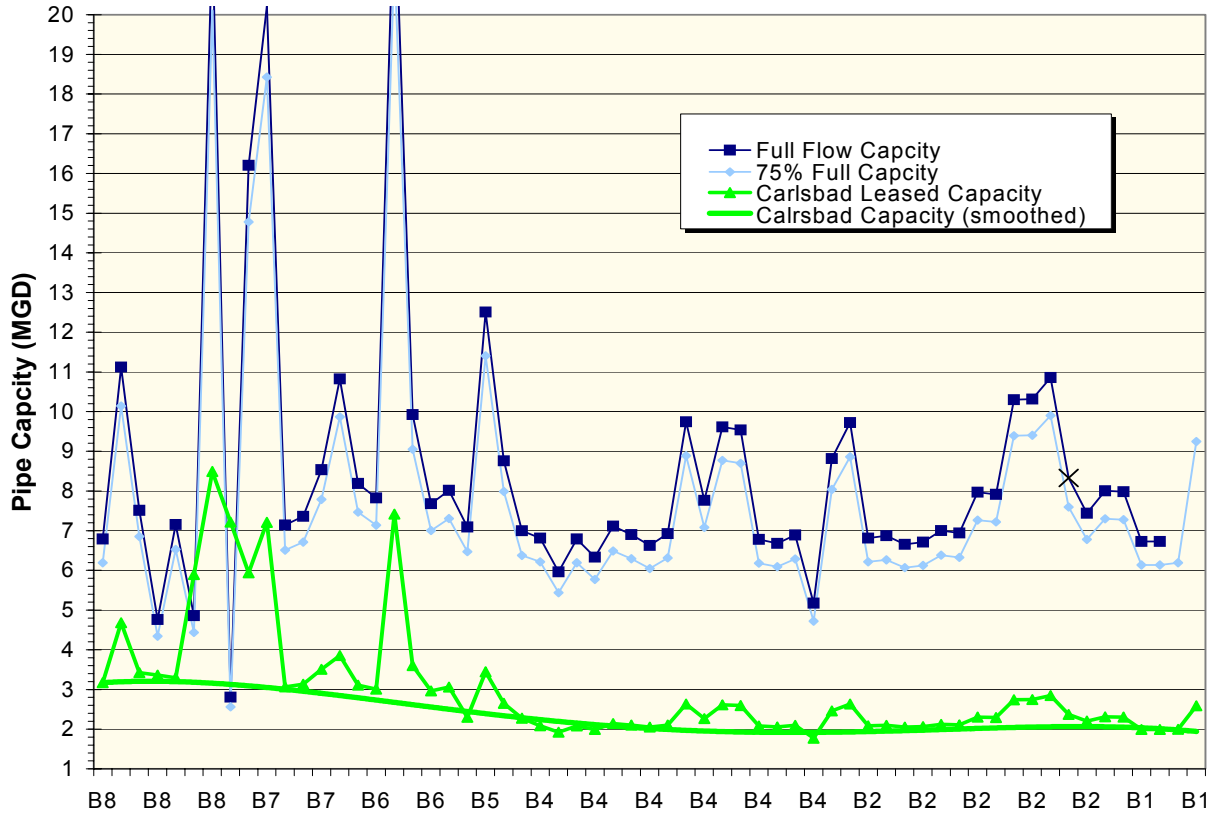
The original agreement for the lease of capacity by Carlsbad in the Buena Interceptor was prepared in 1966, and the agreement was replaced with a new agreement in 1981. The 1981 agreement defines Carlsbad's ownership rights in the interceptor, which increase in the direction of flow and approach 35 percent ownership in the downstream reaches. In 1987, a third agreement was drafted to lease additional

capacity on a temporary basis. Under this agreement, the City of Carlsbad can discharge an additional peak flow rate of 0.8 MGD into the Buena Interceptor until a replacement sewer is constructed. The current ownership and capacity rights based on flow capacities calculated from GIS data are summarized in Table 3-2 and illustrated on Figure 3-7.

Table 3-2
CARLSBAD CAPACITY RIGHTS IN THE BUENA INTERCEPTOR

Pipeline Reach	Min. size (in.)	Min. Slope	Full Flow Capacity (MGD)	75% full Capacity (MGD)	Carlsbad Percent Ownership	Carlsbad Capacity (MGD)	
						100% full Capacity	With Add'l 0.8 MGD
B1	15	2.60%	6.73	6.14	17.65%	1.19	1.99
B2	18	0.96%	6.65	6.07	18.84%	1.25	2.05
B4	18	0.58%	5.17	4.72	18.84%	0.97	1.77
B5	21	0.48%	7.10	6.47	21.13%	1.50	2.30
B6	21	0.56%	7.68	7.00	28.21%	2.17	2.97
B7	24	0.25%	7.36	6.71	31.71%	2.33	3.13
B8	30	0.07%	6.79	6.19	34.88%	2.37	3.17

Figure 3-7
CAPACITY OF THE BUENA INTERCEPTOR



In the downstream reaches of B7 and B8, three isolated pipelines have very flat slopes. Two 30-inch diameter pipelines in Reach B8 have a slope of 0.03 percent, and are fairly short pipelines (less than 200-feet). The 24-inch pipeline in Reach B7 is nearly 600 feet in length and has a slope of 0.04 percent, resulting in a capacity of less than 3 MGD (indicated by an "X" data point marker in Figure 3-4). Both of the pipelines up- and downstream have much steeper slopes, and a hydraulic jump will occur near the upstream manhole. The upstream manhole should be inspected for signs of surcharge, since existing flows in this reach are higher than the computed pipeline capacity. Consistent with the previous Master Plan, these flat segments are not considered in the calculation of the City of Carlsbad leased capacity in Table 3-2.

Vallecitos Interceptor

The Vallecitos Interceptor was constructed nearly 20 years after the Buena Interceptor by the San Marcos County Water District, which is now the Vallecitos Water District (VWD). The City of Carlsbad, City of Vista and the VWD share capacity ownership in this pipeline. The Vallecitos Interceptor begins at the end of the Vallecitos siphon near the intersection of Camino Vida Roble and El Camino Real, downstream of the discharge of the Vallecitos Lift Station. The interceptor then follows Palomar Airport Road in the same approximate alignment as the Buena Interceptor, crossing under Interstate 5 to the Encina WPCF. The total length of the interceptor is approximately 3.4 miles.

The existing interceptor, constructed in 1983, consists of gravity pipelines ranging from 30 to 54 inches in diameter and includes two siphons near the upstream end. There are no lift stations along the alignment. The gravity pipelines are constructed of VCP with the exception of the downstream 54-inch section, which is constructed of DIP. The Vallecitos Interceptor currently serves portions of LFMZs 5, 13, 18 and 20. The ultimate service area will increase to include all of LFMZs 10 and 17, and the portion of LFMZ 6 that is currently served from LCWD.

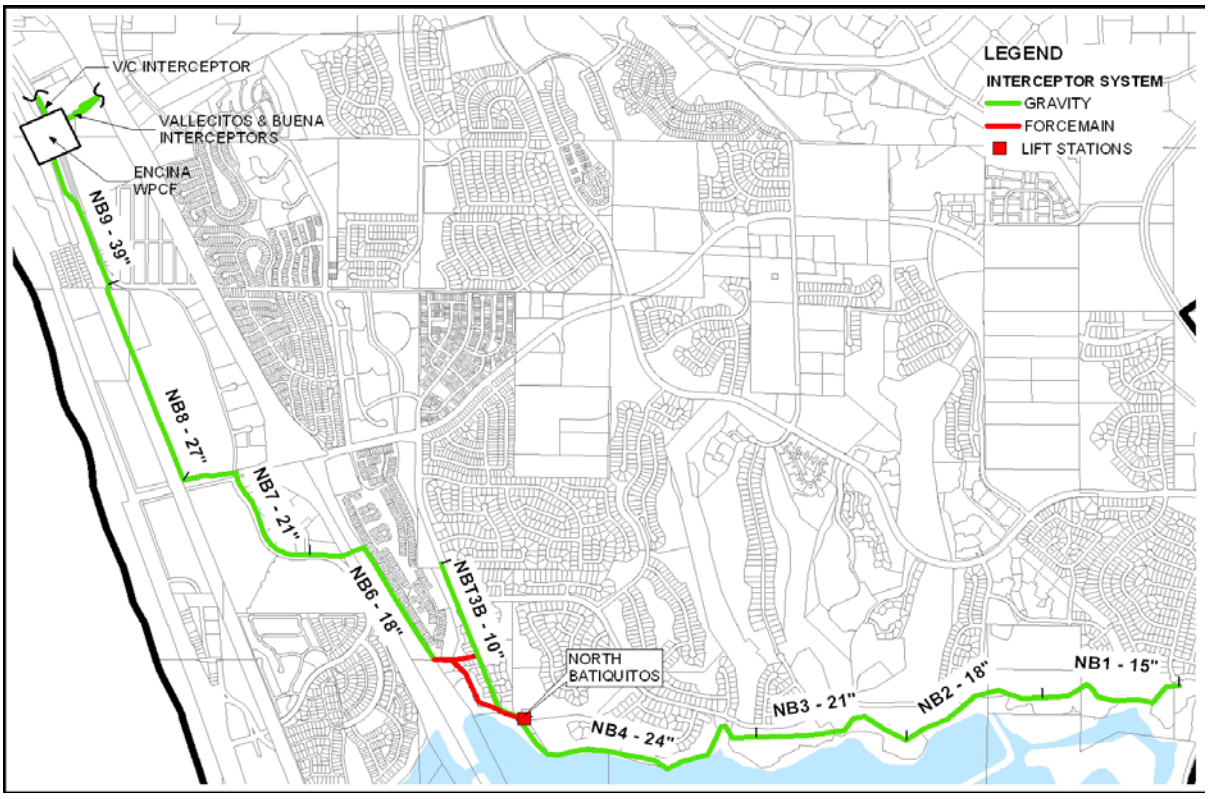
The title of the original interagency agreement for the Vallecitos Interceptor is the Palomar Joint Land Outfall Interceptor Interagency Agreement, which was signed in 1985. Under this agreement, the City of Carlsbad has a 24 percent capacity ownership and can discharge a peak flow rate of 5.0 MGD into the Vallecitos Interceptor. Portions of the Vallecitos Interceptor are reported to be in poor condition, and VWD plans to replace the pipeline in the future. Additionally, the City of Vista has plans to discharge a portion of the future flows from the Buena and Raceway Lift Stations to the Vallecitos Interceptor. The force mains from these two lift stations currently discharge to the Buena Interceptor.

3.2.3 North Batiquitos Interceptor

The North Batiquitos (NB) Interceptor collects only City of Carlsbad flows in the upper reaches. The last 2,415 feet into the Encina WPCF is jointly owned by the City of Carlsbad, the LCWD, and the Encinitas Sanitary Division of the City of Encinitas. This downstream section is sometimes referred to as the Ponto Interceptor, and it was originally termed the Occidental Sewer. The NB Interceptor begins on the north shore of the Batiquitos Lagoon near El Camino Real. The interceptor flows west along the north shore of the lagoon to the NB Lift Station. The NB Lift Station pumps City of Carlsbad flows up and across Interstate 5. West of Interstate 5 the interceptor turns north and collects flow the LCWD and ESD. The NB Interceptor then continues in a northerly direction along the railroad easement to the Encina WPCF.

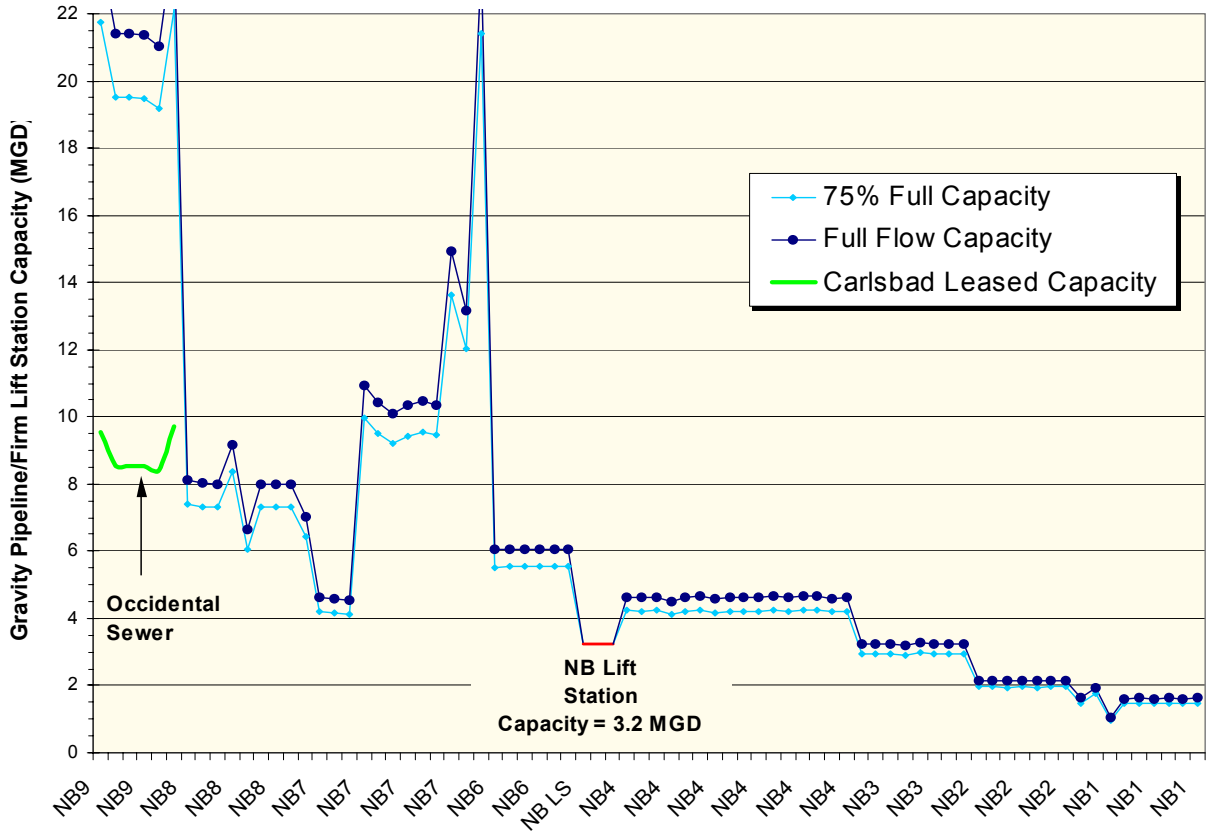
The jointly-owned portion of the NB Interceptor was constructed in 1974 and is approximately 1.6 miles in length. The last 1,000 foot section was originally constructed as a 24-inch diameter siphon, but was replaced with a 48-inch diameter gravity sewer as part of the Encina WPCF Phase III expansion. The interceptor south of Avenida Encinas, which conveys only City of Carlsbad flows, is approximately 5.9 miles in length. The gravity pipelines range in size from 8 to 48 inches in diameter, and are constructed of VCP. The NB Interceptor currently serves all of LFMZs 9 and 19, most of LFMZ 21, and portions of LFMZs 4, 6, 20 and 22. The ultimate service area is anticipated to remain the same. The North Batiquitos Interceptor is illustrated on Figure 3-8.

Figure 3-8
NORTH BATIQUITOS INTERCEPTOR



Ownership of the Ponto (Occidental) section of the NB Interceptor is stipulated in the Occidental-Carlsbad-Leucadia-Encinitas Agreement of 1972. Capacity is identified as: 40.0 percent Carlsbad, 40.3 percent Leucadia and 19.7 percent ESD. Based on a full flow capacity of 21.3 MGD for the 39-inch pipeline, the peak flow capacity for Carlsbad is approximately 8.5 MGD. Costs for operation and maintenance of the Occidental Sewer are stipulated to be shared in the same percentages, with Carlsbad named as the agency responsible for management of maintenance Capacities of the gravity pipelines based on GIS data are shown on Figure 3-9.

Figure 3-9
CAPACITY OF THE NORTH BATIQUITOS INTERCEPTOR



3.3 COLLECTOR SYSTEM

In addition to the approximately 30 miles of interceptor sewers, the City of Carlsbad currently owns, operates and maintains approximately 207 miles of wastewater conveyance pipelines, including gravity flow conduits and forcemains. The collector system also includes approximately 5,000 manholes. Collector system pipelines range in size from 3 to 27 inches in diameter. Gravity pipe materials used throughout the system include polyvinyl chloride (PVC), vitrified clay (VCP), and ductile Iron (DIP).

Forcemains within the District are constructed of ductile iron (DIP), cast iron (CIP), PVC, and Asbestos Cement (AC) pipe materials. Exhibit 1 in Appendix A provides an illustration of the existing wastewater collection and conveyance system included in the sewer system GIS. Table 3-3 presents a summary by pipeline diameters of the City of Carlsbad conveyance facilities, which excludes the interceptor sewers discussed in the previous section.

Table 3-3
CARLSBAD CONVEYANCE SYSTEM SUMMARY
(Excluding Interceptor Sewers)

Pipeline Diameter (in)	Total Length of Pipelines		Pipeline Diameter (in)	Total Length of Pipelines	
	Gravity (lf)	Forcemain (lf)		Gravity (lf)	Forcemain (lf)
3	144	423	15	8,845	---
4	3,438	2,107	16	---	---
6	62,849	7,640	18	4,555	---
8	851,986	5,654	20	2,050	---
10	76,621	3,161	21	1,194	---
12	45,222	3,623	24	5,570	---
14	---	2,966	27	2,096	---
TOTALS:	**Gravity - 1,064,570**			**Force Mains - 25,574**	

The summary information in Table 3-3 was obtained from the City of Carlsbad Sewer System GIS, which includes pipelines constructed up through 2001. Information in the Sewer System GIS was obtained from as-built drawings, construction drawings, and the City's existing Sewer Atlas Book. Information from the Sewer Atlas Books was used for pipelines for which no design drawings could be located (primarily in the older "village" areas).

3.4 LIFT STATIONS AND FORCEMAINS

Eighteen wastewater lift stations are currently located within the City of Carlsbad Sewer Service Area. The Buena Vista and Agua Hedionda Lift Stations, which are part of the V/C Interceptor, are operated and maintained by the Encina Wastewater Authority. The remainder of the lift stations are owned and operated by the City of Carlsbad. Figure 3-10 illustrates the lift station locations and associated forcemain alignments, and Table 3-4 provides a summary of lift station capacities and features. Table 3-4 is organized according to the downstream interceptor system to which each lift station currently discharges. As noted on the table, several lift stations are pumping "out of basin". These lift stations may be eliminated with the construction of the future South Agua Hedionda Interceptor and/or other additional collector sewers.

OCEANSIDE

FOREST LIFT STATION

VANCOUVER LIFT STATION

SIMSBURY LIFT STATION

BUENA VISTA LIFT STATION

HOME PLANT LIFT STATION

VILLAS LIFT STATION

OCEANSIDE

WOODSTOCK LIFT STATION

GATESHED LIFT STATION

FOX'S LANDING LIFT STATION

CHINQUAPIN LIFT STATION

VISTA

KELLY RANCH LIFT STATION

AGUA HEDIONDA LIFT STATION

FARADAY NO. 2 LIFT STATION

FARADAY LIFT STATION

TERRAMAR LIFT STATION

LA GOLONDRINA LIFT STATION

POINSETTIA LIFT STATION

SAN MARCOS

SAND SHELL LIFT STATION

NORTH BATIQUITOS LIFT STATION

KNOTS LANE LIFT STATION

MARRON ROAD

BUENA VISTA LAGOON

VILLAGE DRIVE

CARLSBAD BOULEVARD

TAMARACK AVENUE

EL CAMINO REAL

AGUA HEDIONDA LAGOON

CANNON ROAD

COLLEGE BOULEVARD

AIRPORT ROAD

PALOMAR AIRPORT ROAD

POINSETTIA LANE

AVIARA PARKWAY

ALGA ROAD

LA COSTA BOULEVARD

LAKE CALAVERA

BATIQUITOS LAGOON

5

CITY OF CARLSBAD CALIFORNIA

INCORPORATED 1952

LEGEND

- SEWER SERVICE AREA BOUNDARY
- EXISTING LIFT STATIONS
- FORCEMAIN
- GRAVITY INTERCEPTOR SEWER
- SIPHON

N

1"=4000'

FIGURE 3-10

CITY OF CARLSBAD
EXISTING LIFT STATIONS AND FORCEMAINS

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Table 3-4

SUMMARY OF EXISTING LIFT STATIONS

Lift Station Name	Interceptor System Discharge	Construction/ Rehabilitation Date	Pump Information			Station Capacity [1]		Force Main Diam.	Flow Meter	Comments
			Qty.	Motor	Design Point	(gpm)	(MGD)			
Terramar	V/C	1972	2	3 Hp	100 gpm @ 25'	100	0.14	8"	Yes	
Chinquapin	V/C	1959/2001	2	7.5 Hp	360 gpm @ 50'	360	0.52	6"	Yes	
Forest [2]	V/C	1950/2001	2	7.5 Hp	360 gpm @ 43'	360	0.52	6"		gravity line is in design
Home Plant	V/C	1963/1991	3	20Hp - 1 VFD	800 gpm @ 70'	800	1.15	10"	Yes	
Buena Vista	V/C	1975/1994	4	300 Hp - VFD	6000 gpm @ 142'	14,900 [4]	21.50	16&24"	Yes	operated by Encina
Agua Hedionda	V/C	1976/1988	4	100 Hp - VFD	8000 gpm	16,000	23.04	2-18"	Yes	operated by Encina; 2 duty & 2 standby pumps
Gateshead [2]	NAH [3]	1985	2	3 Hp	40 gpm @ 25'	40	0.06	4"		Gorman Rupp package station
Vancouver [2]	NAH [3]	1981	2	15 Hp	150 gpm @ 103'	150	0.22	8"	Yes	S&L package station
Kelly Ranch [2]	NAH [3]	2001	2	10 Hp	325 gpm @ 61'	325	0.47	6"		48,000 gal overflow tank
Simsbury [2]	NAH [3]	1985	2	50 Hp	382 gpm @ 200'	382	0.55	8"	Yes	
Villas [2]	NAH [3]	1983	2	15 Hp	125 gpm @ 90'	125	0.18	4"	Yes	Gorman Rupp package station
Woodstock [2]	NAH [3]	1983	2	2 Hp	50 gpm @ 25'	50	0.07	3"		Gorman Rupp package station
Foxes	NAH	2001	3	38.7 Hp- VFD	1500 gpm @ 61'	2,600	3.74	12"	Yes	
Lower Faraday #14 [2]	Vallecitos [3]	1995	2	25 Hp	307 gpm @ 144'	307	0.44	6"		
Upper Faraday #10 [2]	Vallecitos [3]	1991	2	25 Hp	1000 gpm @ 55'	1,000	1.44	14"	Yes	
Poinsettia	Vallecitos	2000	3	125 Hp	850 gpm @ 247'	1,230	1.77	12"	Yes	
Batiquitos	NB	1997	3	100 Hp	1210 gpm @ 164'	2,250	3.24	2-14"	Yes	172,300 gal overflow tank
Knots Lane	NB	1999	2	10 Hp	355 gpm @ 44'	355	0.51	6"	Yes	
Sand Shell	NB	2002	2	10 Hp				6"	Yes	
La Golondrina [2]	LCWD [3]	1981	2	5 Hp	110 gpm @ 45'	110	0.16	4"		S&L package station

(1) Station Capacity is the duty capacity with one pump out-of-service, except for the Agua Hedionda LS which assumes 2 pumps out-of-service

(2) Temporary lift station to be eliminated with the construction of a future gravity pipeline

(3) Lift station currently discharges out-of-basin

(4) Lift station can't operate in excess of 15.8 MGD (11,000 gpm) w/o written authorization from Carlsbad

The firm capacity of a lift station, as indicated in Table 3-4, is the hydraulic output of the installed pumping units with the largest pumping unit out-of-service. The "installed" capacity of a lift station is equal to the hydraulic output of all installed pumping units. The "hydraulic output" of a single pump is defined by the certified pump curve, the losses within the forcemain system, and design operation point for the equipment. The hydraulic output of several pumps working in parallel is defined by the cumulative hydraulic effect of the pumps, and is not equal to the mathematical sum of the individual nameplate pump capacities. A hydraulic analysis of both the pump and the forcemain systems is required to determine the hydraulic output of a given lift station. The majority of the Carlsbad lift stations consist of two pumping units designed in an alternating lead/lag configuration, but operated in a duty/standby mode. This means that under normal operating conditions, only one pump is operating at a time and the pumps alternate as the pumps start and stop. However, if one pump can not keep up or fails to start, the second pump will operate automatically.

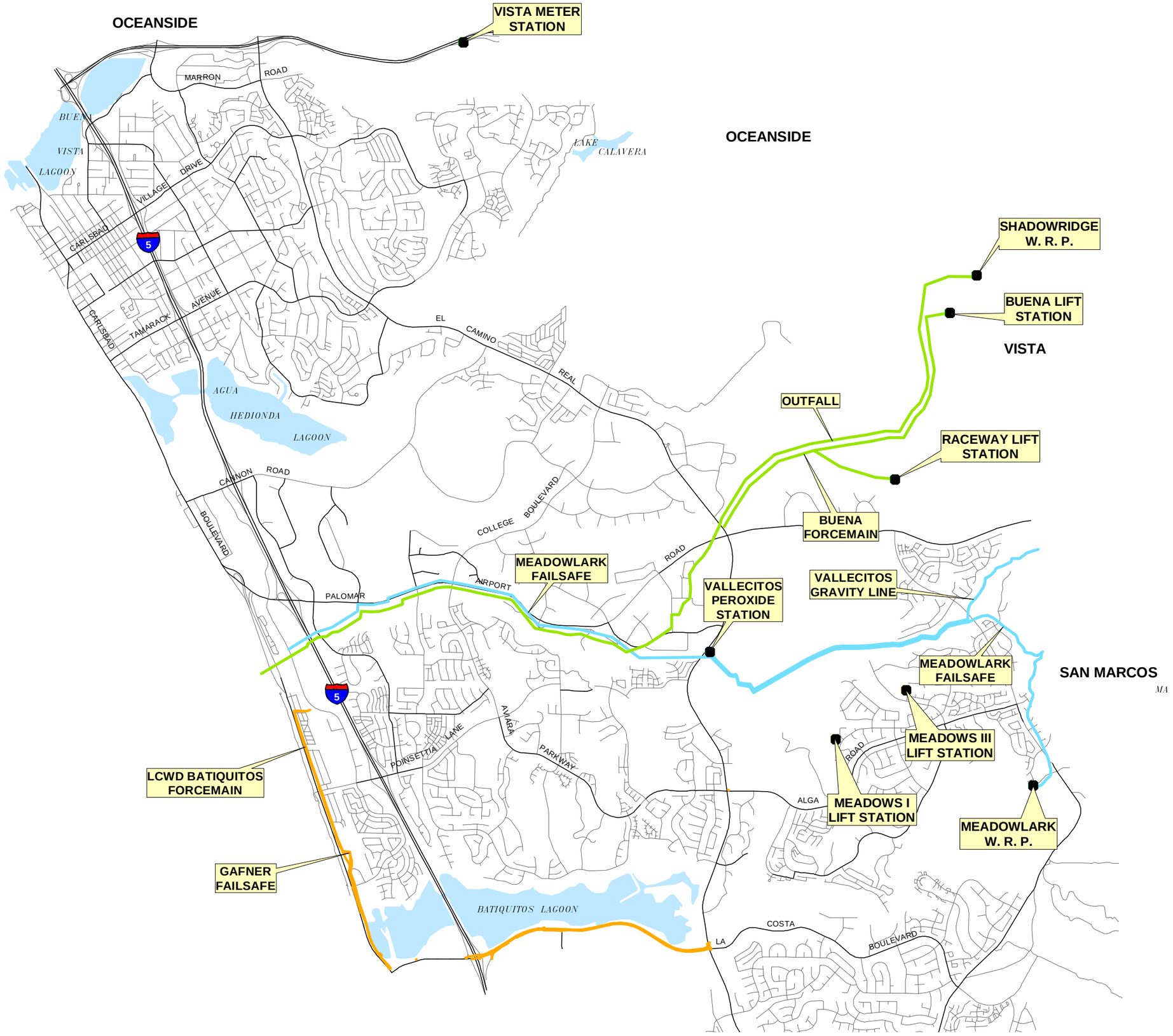
Each of the lift stations has standby power capability consisting of either installed generators or a connection for a portable generator. When station alarms occur, a signal is sent to the District Control Center by telephone line. The Home Plant, Foxes and North Batiquitos stations are equipped with full telemetry. Odor control consisting of air injection on the force main to prevent production of hydrogen sulfide is provided at the Lower Faraday Lift Station. At the other stations, the wet wells are cleaned periodically.

Many of the lift stations have recently undergone, or are planned to undergo, rehabilitation projects to improve station operation and reliability. A site visit to each pump station was conducted as part of the 1997 Master Plan Update. Appendix B of that report contained a detailed inventory of the mechanical and electrical equipment compiled by City staff. Since the last master plan the Poinsettia, Kelly Ranch, Knots Lane, and Sand Shell Lift Stations have been constructed and the Foxes Landing and Chinquapin Lift Stations have been rehabilitated.

3.5 INTER-AGENCY AGREEMENTS

Wastewater collection systems operate primarily on a gravity flow basis. However, political boundaries are not always established to match natural drainage contours. As a result, some portions of a given service area may drain in an undesirable direction, away from the remainder of the gravity collection system. Inter-agency agreements can be developed to allow the wastewater flows to be conveyed into the collection system of an adjacent District or agency.

The City jointly owns capacity in most of the interceptors with upstream sewering agencies, as described previously in Section 3.2. The joint ownership agreements are summarized in Table 3-5 and included in Appendix B. Figure 3-11 illustrates other agency facilities that are within the Carlsbad Sewer Service Area or along its boundary.



CITY OF CARLSBAD CALIFORNIA

INCORPORATED 1952

LEGEND

- LCWD SEWER FACILITIES
- CITY OF VISTA/BSD SEWER FACILITIES
- VALLECITOS SEWER FACILITIES

NOTE: SEWER INTERCEPTORS CONVEYING CARLSBAD FLOWS ARE NOT SHOWN

N

1"=4000'

FIGURE 3-11

CITY OF CARLSBAD
OTHER AGENCY WASTEWATER FACILITIES

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Table 3-5
INTER-AGENCY AGREEMENTS FOR SEWER INTERCEPTORS

Interceptor	Joint Agency	Agreement/Date
Vista/ Carlsbad	City of Vista	Agreement for Ownership, Operation, and Maintenance of the Vista/Carlsbad Interceptor Sewer- 2/26/02
Buena	Buena Sanitation District	Agreement Between the BSD and City of Carlsbad for the Lease of Capacity in the Encina Outfall - 12/15/81 Agreement between the BSD and City of Carlsbad for the Lease of Additional Capacity in the Encina Outfall - 1987
Vallecitos	San Marcos Water District City of Vista	Palomar Joint Land Outfall Interceptor Interagency Agreement - 1/8/95
North Batiquitos	Leucadia County Water District Encinitas Sanitary District	Occidental-Carlsbad-Leucadia-Encinitas Agreement in Regard to Construction of Sewer Pipeline South from the Encina Water Pollution Control Facility - 8/24/72

In addition to the inter-agency agreements for the interceptors, the City of Carlsbad has agreements with LCWD to provide sewer service to isolated areas of La Costa located along the Sewer Service Area boundary. Tract 73-29, also known as Carrillo Estates Unit No. 2, is a 111 lot subdivision that comprises sub-drainage basin 6B. Wastewater from this development is currently pumped by the La Golondrina Lift Station to the LCWD Meadows I Pump Station (shown on Figure 3-11). The topography of the property is such that wastewater collected on the property will flow to the Vallecitos Interceptor in the future, after additional off-site gravity conveyance facilities are constructed. Agreements were signed between the City of Carlsbad and the LCWD to transfer 111 EDU's of capacity and flow from the LCWD to Carlsbad on EWA flow and EDU reports, until such time as the wastewater service by the LCWD is terminated. This agreement has been in effect since 1981 and shall not expire until wastewater collection facilities tributary to the City of Carlsbad system are constructed and connected.

Tract 93-04, also known as Rancho Carrillo Village Q, is a 25 lot subdivision located in the southwest corner of sub-drainage basin 18B. Wastewater collected on the property will also flow to the Vallecitos Interceptor in the future, after additional off-site gravity conveyance and lift station facilities are constructed. The City of Carlsbad and the developer requested a temporary connection to the wet well of the LCWD Meadows III Pump Station, which is located just south of the Carlsbad Sewer Service Area boundary, as shown on Figure 3-11. A Reimbursement Agreement for Temporary Wastewater Collection was approved in October 1998. The agreement will remain in force until off-site facilities tributary to Carlsbad are completed. Once these facilities are constructed, the LCWD may consider negotiating a future agreement with Carlsbad for the detachment of the remaining 68 additional lots served by the Meadows III Pump Station.

3.6 WASTEWATER TREATMENT AND DISPOSAL

Wastewater generated within the City of Carlsbad Sewer Service Area is treated at the Encina WPCF. The Encina WPCF provides full secondary treatment, sludge handling, and disposal through a deep ocean outfall. The treatment levels meet current State and Federal requirements for secondary treatment. The Encina WPCF is owned and operated by the Encina Wastewater Authority (EWA), a joint powers authority made up of six northern San Diego County wastewater agencies. The EWA maintains a 10 member Board consisting of council members or directors from each of the member agencies. The EWA operates and maintains the Encina Wastewater Pollution Control Facility (WPCF) (Unit 1) and ocean outfall (Unit J) and the Buena Vista and Agua Hedionda Lift Stations. Vista and Carlsbad share the operation and maintenance expenses for the Buena Vista and Agua Hedionda Lift Stations.

3.6.1 Treatment

EWA's state-of-the-art treatment facility is designed to treat wastewater to the secondary level. Most of the treatment plant's highly treated wastewater is discharged into the ocean through an outfall. Treatment processes at the Encina WPCF include screening, grit removal, primary clarification, and treatment of activated sludge. The waste activated sludge is thickened and pumped to anerobic digester for stabilization. The digested sludge is then dewatered and used as a soil amendment. Sludge hauling and handling is done by private contractors. Digester gas is used to fuel gas driven blowers and generators to reduce outside energy dependence.

The capacity of the EWA facility has been expanded several times. The current rated liquid capacity is 36.0 MGD while the rated solids handing capacity is 38.0 MGD. The difference in the two capacities represents the equivalent amount of sludge that is disposed back to the sewer system from the Shadowridge WRP and the Gafner WRP. These two plants rely upon the Encina WPCF for sludge digestion, dewatering, and disposal. However, the Gafner WRP has ceased primary and secondary treatment and no longer discharges sludge to the plant.

3.6.2 Disposal

Effluent from the EWA plant is discharged to the Pacific Ocean through the Encina Ocean Outfall. The Encina Ocean Outfall system includes the Interim Flow Equalization Facilities, the Effluent Pump Station, and the outfall. When the influent flows exceed the hydraulic capacity of the outfall, the excess flow is diverted to the flow equalization facilities. When the flow rates fall to within acceptable levels, the stored flow is pumped from the basins back to the outfall. The equalization allows the plant to pass high flows associated with storm events at a flow rate greater than the hydraulic capacity of the downstream outfall.

The Encina outfall extends along the ocean floor to a point 1.5 miles off shore, at a depth of over 150 feet. The outfall pipeline consists of two individual sections, including the original 48-inch, 6,600-foot outfall constructed in 1965 and the 72-inch, 2,300-foot extension constructed in 1973. The outfall extension project also added an 800-foot diffuser system to the end of the outfall. The current capacity of the Encina Ocean Outfall is estimated to be approximately 75 MGD. This wet weather flow capacity takes into account the flow equalization facilities.

3.6.3 Ownership

Each EWA member agency has capacity rights to the Encina WPCF and the ocean outfall system. Capacity rights are documented in the Revised Basic Agreement, which was last amended in February 2000. A copy of this agreement is included in Appendix B. In the basic agreement, treatment facilities are referred to as Unit I, and the ownership is broken down into liquid and solids handling portions. The City of Carlsbad currently has a capacity ownership of 9.24 MGD for both liquid and solids. The ocean outfall system is referred to as Unit J. Carlsbad's capacity right for Unit J is 25.54 MGD. Table 3-6 provides a summary of the current EWA ownership.

Table 3-6
ENCINA WPCF CAPACITY OWNERSHIP

Encina Member Agency	WPCF (Unit I)				Outfall (Unit J)		
	Treatment		Solids				
	Percentage	ADWF MGD	Percentage	ADWF MGD	Percentage	ADWF MGD	PWWF* MGD
Carlsbad	25.67%	9.24	24.32%	9.24	24.32%	9.24	25.51
City of Vista	22.36%	8.05	21.18%	8.05	21.18%	8.05	22.21
Vallecitos	20.94%	7.54	19.84%	7.54	19.84%	7.54	20.81
Leucadia	19.75%	7.11	20.68%	7.86	20.68%	7.86	21.69
Buena	6.28%	2.26	9.24%	3.51	9.24%	3.51	9.69
Encinitas	5.00%	1.80	4.74%	1.80	4.74%	1.80	4.97
Totals	100%	36.0	100%	38.0	100%	38.0	104.9

* Peak wet weather flows are based on a peaking factor of 2.76 times the ADWF

CHAPTER 4
EXISTING WASTEWATER FLOWS

As population has grown and the northern coastal areas of San Diego County continue to develop, the City of Carlsbad has experienced gradually increasing wastewater volumes. This chapter documents existing wastewater flows within the sewer service area. Historical wastewater flows are summarized and unit flows are developed for residential and commercial/industrial areas. Peaking curves for each interceptor system and contributing upstream agency are developed for dry weather flows. Existing defect flows from rainfall-induced inflow and infiltration are quantified based on historical events.

4.1 ENCINA FLOW METERS

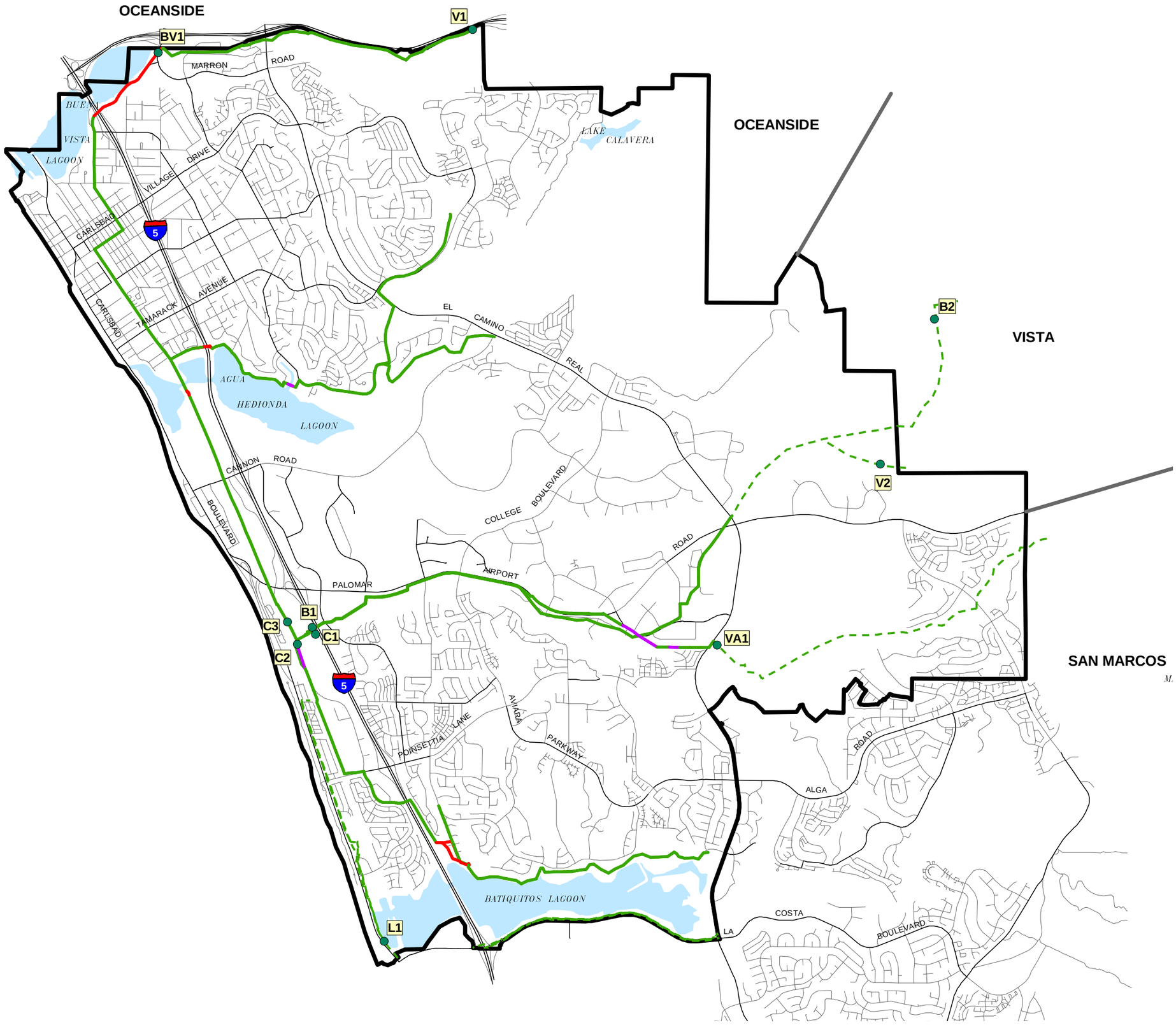
The Encina Wastewater Authority operates and maintains numerous flow meters throughout the service areas of its six member agencies. A Centralized Flow Metering Program was implemented in 1989 and meter upgrades were last made in 1996. Wastewater flows generated within the City of Carlsbad are metered in the interceptor pipelines upstream of the Encina WPCF. Because of flow contributions from upstream agencies, Carlsbad flows must be determined by subtracting other agency flows from measured flows at the WPCF. Figure 4-1 illustrates the locations of the Encina meters that are used to calculate Carlsbad flows. Details of each meter are provided in Table 4-1. The total flow from Carlsbad is calculated from the following formula:

$$\text{Carlsbad flow} = (C3\text{-}V1) + (B1\text{-}(B2 + V2)) + (C1\text{-}VA1) + (C2\text{-}L1)$$

Table 4-1
ENCINA FLOW METERS

Meter ID.	Location	Meter Type	Metered Flow	
			Carlsbad	Other Agencies
V1	Haymar Drive in Vista	ADS 3600*	---	Vista & O'side
BVPS	Discharge of the Buena Vista L.S.	Ultrasonic	Portions of the V/C Interceptor	Vista & O'side (V1)
C3	VC influent line to the Encina WPCF	ADS 3600*	V/C and NAH Interceptors	Vista & O'side (V1)
B2	Discharge of the BSD Buena L.S.	Magmeter	---	Buena Sanitation District
V2	Downstream of the Vista Raceway L.S.	ADS 3600*	---	Raceway basin (Vista)
B1	Buena influent line to the Encina WPCF	ADS 3600*	Buena Interceptor	BSD & Raceway (B2, V2)
VA1	Downstream of the Vallecitos L.S.	Ultrasonic	---	Vallecitos
C1	Vallecitos influent line to the Encina WPCF	ADS 3600*	Vallecitos Interceptor	Vallecitos (VA1)
L1	Discharge of Batiquitos L.S.	Ultrasonic	---	LCWD and ESD
C2	NB influent line to the Encina WPCF	ADS 3600*	North Batiquitos Interceptor	LCWD and ESD (L1)

* Accuracy of the Model 3600 meter is within plus or minus 5% under ideal flow conditions



CITY OF CARLSBAD
CALIFORNIA

LEGEND

- SEWER SERVICE AREA BOUNDARY
- ENCINA FLOW METERS

SEWER INTERCEPTOR SYSTEM

- GRAVITY SEWER
- FORCEMAIN
- SIPHON
- UPSTREAM AGENCY FACILITIES

N

1"=4000'

FIGURE 4-1

CITY OF CARLSBAD
ENCINA FLOW METER LOCATIONS

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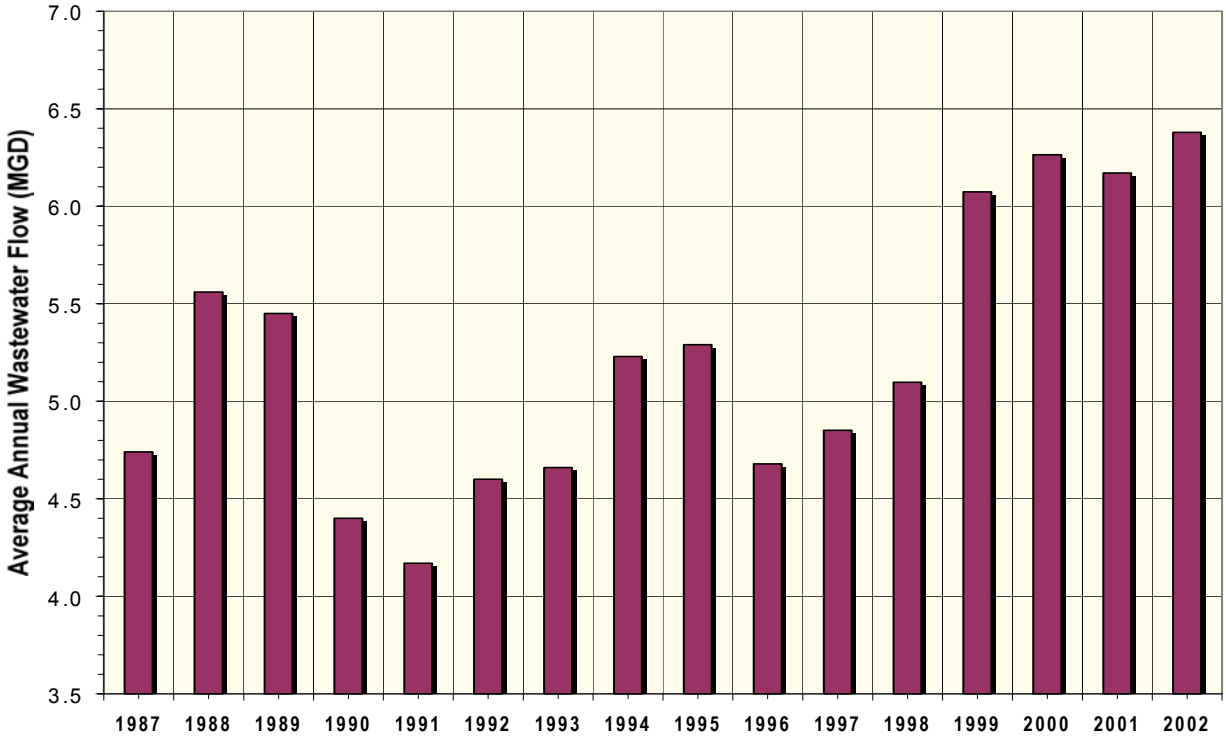
4.2 HISTORICAL FLOWS

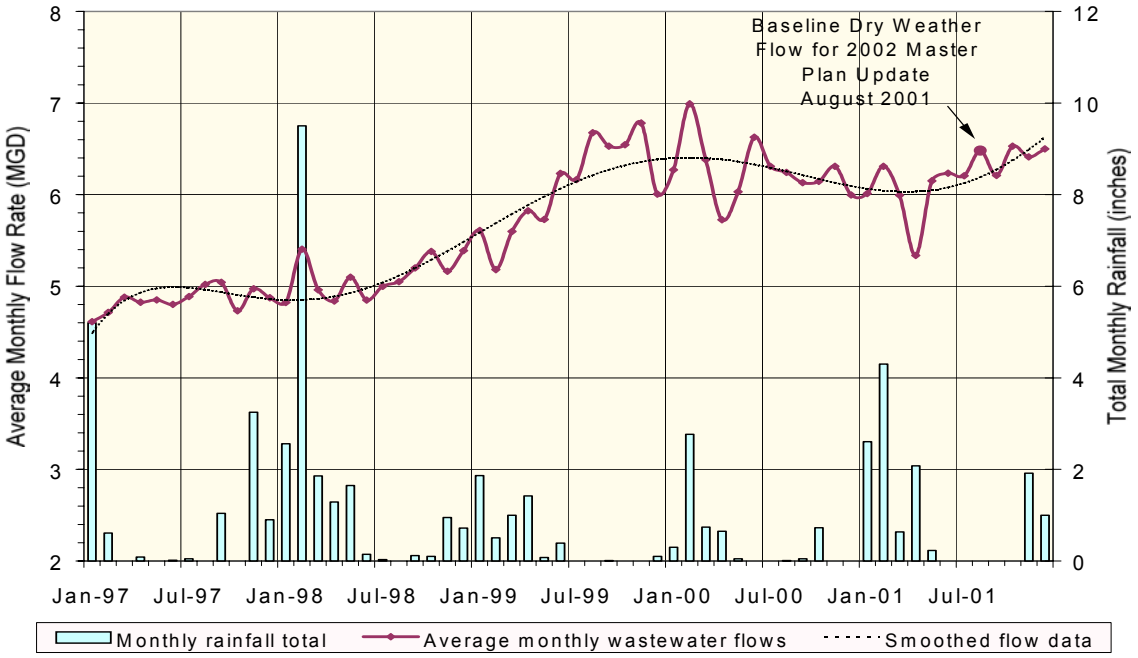
Carlsbad average annual wastewater flows, as calculated from Encina meter data, are summarized for the past 15 years on Figure 4-2. As shown on the chart, wastewater flows decreased significantly after 1989. This was typical of most Southern California sewage agencies, and can be attributed to conservation measures implemented during drought conditions. Some of the conservation measures were temporary but many, such as the installation of low-flow bathroom fixtures, have had a lasting effect. Flow meters were replaced at the beginning of 1996, and the improved accuracy may have contributed to the flow decrease observed after 1995. It is only over the past four years that wastewater flows have surpassed flows generated in the late 1980's. The higher flows are a result of steady increases population, as land use within the service areas has transitioned from mainly agricultural use to urbanized development.

Figure 4-2
HISTORICAL WASTEWATER FLOWS



Monthly wastewater flows for the past five years are shown on Figure 4-3, along with monthly rainfall totals. From this graph there appears to be slightly higher monthly flows during months where the total rainfall exceeds about four inches. However, there are also several large flow fluctuations that cannot be explained. Overall, there is no strong trend of peak flows occurring in any particular month or season.

Figure 4-3
5-YEAR MONTHLY WASTEWATER FLOWS VS. RAINFALL



4.3 AVERAGE DRY WEATHER FLOWS

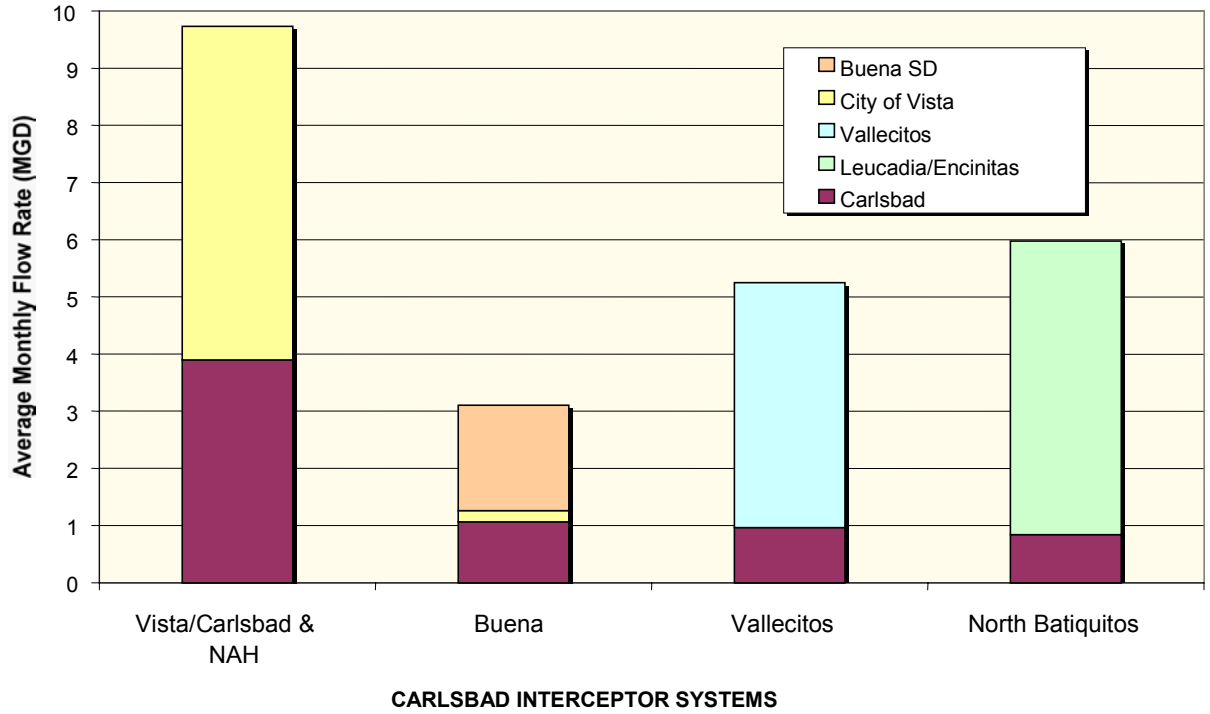
For this Master Plan Update, EWA meter data for August 2001 was used to determine the existing average dry weather flow (ADWF). The month of August was selected because it was the most recent month during the dry season in which the meters appeared to be operating properly and complete flow data could be obtained. Table 4-2 summarizes the average flow for Carlsbad and the other EWA agencies for August 2001. This information is illustrated graphically by interceptor system on Figure 4-4.

Table 4-2
AUGUST 2001 ENCINA MEMBER AGENCY FLOW SUMMARY

Interceptor System	Carlsbad Flows	Other Agency Flows		Total Flow
		Agency	Flow	
Vista/Carlsbad & NAH	3.89 MGD	City of Vista	5.84 MGD	9.73 MGD
Buena	1.06 MGD	Buena Vista (raceway)	1.84 MGD 0.20 MGD	3.10 MGD
Vallecitos	0.97 MGD	Vallecitos	4.28 MGD	5.25 MGD
North Batiquitos*	0.56 MGD	Leucadia/Encinitas	5.14 MGD	5.70 MGD
Totals	**6.48 MGD**		**17.30 MGD**	**23.78 MGD**

* Metered flow at EWPCF is .28 MGD less than the upstream flow metered at the North Batiquitos Lift Station.

Figure 4-4
AUGUST 2001 FLOW SUMMARY BY INTERCEPTOR



From Figure 4-4, it is apparent that Carlsbad flows comprise a minority of the total flows in each of the interceptors. This is especially true in the North Batiquitos Interceptor, for which the Carlsbad flow proportion is less than 10 percent of the total flow measured at the Encina WPCF. Because Carlsbad flows are calculated by subtracting upstream and downstream flow meter readings, the resultant flows are dependent on the accuracy of the meters. If the Carlsbad flow contribution is very small relative to the upstream flows, an error of even 3 percent on the upstream and downstream readings can have a large effect on the calculated flow for Carlsbad.

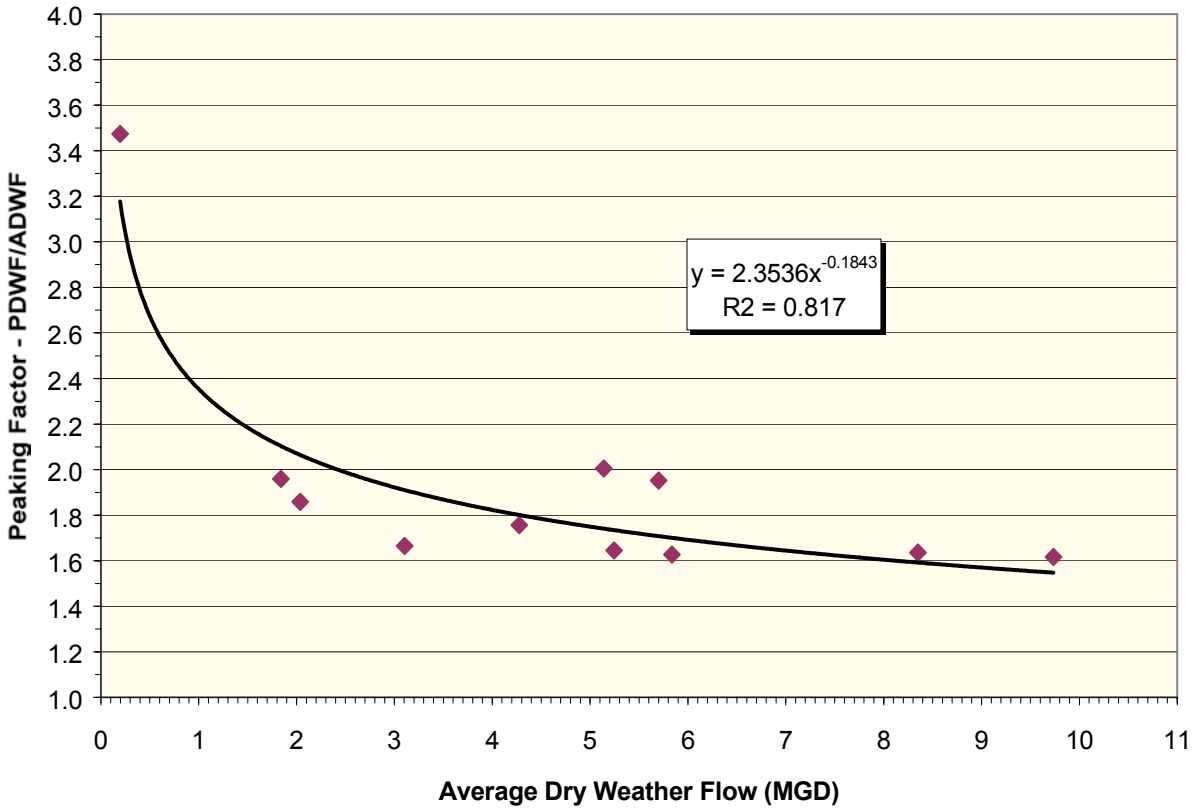
In the North Batiquitos Interceptor, most of the flow generated within Carlsbad is pumped at the North Batiquitos Lift Station. Further downstream Carlsbad flows join with the flows from LCWD and ESD. The City's flow meter at the North Batiquitos Lift Station recorded an average daily flow rate of 0.84 MGD during August 2001, which is 0.28 MGD more than the average flow rate calculated for Carlsbad in the entire NB Interceptor based on the Encina meters (C2-L1). Carlsbad flows are approximately 10 percent of the total flow from LCWD and ESD. Consequently, the flow calculated for Carlsbad based on the Encina meters can vary by as much as 70 percent even if the accuracy of the LCWD/ESD meter (L1) and the meter at the Encina WPCF (C2) are both within +/- 5 percent. The higher flow rate recorded at the North Batiquitos Lift Station was incorporated in the flow calculations for the NB Interceptor because it is more conservative and likely more accurate. The total existing ADWF for Carlsbad is therefore estimated to be 6.8 MGD for this Master Plan Update.

4.4 PEAK DRY WEATHER FLOWS

Flow meter data from the Encina WPCF meters is recorded in 15-minute intervals. To determine the existing peak dry weather flow (PDWF), the daily flow for all days in August 2001 was plotted for each of the Encina meters listed in Table 4-1. The 24-hour flow charts are provided in Appendix C. Flow data from the meters indicates distinct and repeatable peaking trends for weekends and weekdays. During weekdays, peak flows were recorded between 8:00 and 10:00 AM, with a second, usually lower peak at around 9:00 PM. During weekends, the peak morning flows occurred approximately two to three hours later than the weekday flows. Weekend peak flows were higher than the weekday peaks at all meter locations. A lag time for peak flows was also apparent at the downstream meters when compared to upstream meters.

Figure 4-5 illustrates the ratio of peak flows to average flows obtained from the August 2001 Encina meter data, which is provided for informational purposes. Also shown on the chart is a composite peaking flow curve derived from the meter data. As is typical of most sewer systems, the peaking factor is higher as the service area decreases.

Figure 4-5
DRY WEATHER PEAKING FACTOR DATA
Based on Encina Flow Meters for August 2001



4.5 INFLOW AND INFILTRATION

Storm water inflow and infiltration (I&I) is the combination of wet weather infiltration and direct storm inflow that establishes the maximum hydraulic capacity of wastewater conveyance facilities. Infiltration enters the collection system underground, due to either a permanently high groundwater table or as a result of rainfall percolation and temporary rising of groundwater levels. While the amount of infiltration from rainfall events can be estimated from an evaluation of flow data and rainfall records, infiltration that occurs year-round can typically only be detected from pipeline video inspections or manhole inspections. The presence of excessive amounts of infiltration indicates broken or poorly constructed pipes, pipe joints, or manholes.

Inflow in a collection system generally refers to extraneous water that flows directly into the system as a result of storm water runoff. The entry points may be at manholes or from illicit connections to the sewer system, such as roof and yard drains. The rate of inflow depends on the amount and intensity of rainfall and the ground saturation level.

For this Master Plan Update, high intensity rainfall events over the past five years were analyzed to determine the peak I&I. Flow data from select rainfall events were plotted together with the August 2001 24-hour average flow curves developed at each Encina meter location. Estimates of the maximum instantaneous I&I were then made from these plots, which are included in Appendix C. The theoretical peak wet weather flow (PWWF) for each upstream agency and interceptor system is calculated by adding the peak I&I to the PDWF.

Results of the I&I investigation indicate that there are high I&I rates to the Vista/Carlsbad (V/C) Interceptor. Based on the I&I analysis documented in the *City of Vista Infrastructure Review Summary & Wastewater Master Plan Update*, dated July 2001, wastewater flows in the Vista drainage basin remain elevated for several months after periods of heavy rainfall. This is attributed to increased infiltration from high groundwater levels. The inflow during periods of high rainfall is also significant, and is attributed primarily to illicit storm drain connections. The combined peak I&I for City of Vista flows to the V/C Interceptor is estimated at approximately 7 MGD in the 2001 Vista Wastewater Master Plan Update. This results in a PWWF that is nearly 2.9 times the ADWF at the upstream end of the interceptor. An evaluation of flow data from the Encina C3 meter indicates that approximately 4.5 MGD of additional inflow is contributed by Carlsbad from the V/C and North Agua Hedionda (NAH) Interceptors (refer to Section 5.2.4). There are no operating flow meters on the NAH Interceptor, so the origin of the additional I&I cannot be accurately determined.

The I&I contribution from upstream agencies and Carlsbad was estimated in the same manner for the Buena, Vallecitos and North Batiquitos Interceptors. In the Buena Interceptor, a portion of peak flows from the BSD is diverted to the Shadowridge Water Reclamation Plant during high rainfall periods. In

the Vallecitos Interceptor, almost all of the I&I recorded at the downstream Encina meter C1 can be attributed to Vallecitos. The instantaneous peak I&I from Vallecitos is estimated to be approximately 4.0 MGD, and the theoretical PWWF is estimated to be approximately 2.6 times the ADWF. It is not known whether there are currently any upstream pumping limitations that would prevent the total flow from being discharged to the Vallecitos Interceptor. It is noted that Vallecitos was completing its Sewer Master Plan Update at the time of the writing this report.

In the North Batiquitos (NB) Interceptor, the peak I&I flows measured at the downstream Encina meter C2 are typically lower than flows measured in the upstream meter L1, which meters flow from the LCWD and ESD. Because of the upstream NB Lift Station, which employs fixed speed pumping equipment, I&I flow rates for Carlsbad cannot be directly determined from the Encina meters. In the 1999 *LCWD Wastewater Master Plan*, the instantaneous peak I&I flowing to the NB Interceptor was estimated to be approximately 4.2 MGD. Using this flow rate, the PWWF for Leucadia/Encinitas is estimated to be approximately 2.5 times the ADWF.

4.6 EXISTING UNIT FLOW FACTORS

Flow generation factors based on existing flow conditions were developed to distribute flow in the existing system hydraulic computer model. Sewer flow factors were derived from August 2001 Encina flow meter data, parcel information contained in the City's Growth Database, and City of Carlsbad water billing records, which were assigned an assessor parcel number (APN) by City staff. It is noted that the flow generation factors based on existing conditions are different than the flow factors developed to project future flows, which are discussed in Chapter 6 of this report.

4.6.1 Faraday Industrial Unit Flow Study

The service area for the Faraday Upper Lift Station consists primarily of office and light industrial uses, with a few commercial establishments. There are no residential flows tributary to the lift station. An analysis of the flow generated within this service area was conducted to determine existing flow generation rates for industrial business park type developments.

The total flow to the Faraday Upper Lift Station for August 2001 was determined from pump run-time records provided by City of Carlsbad Public Works Operation staff. Water records were obtained and reviewed to determine which parcels had active water usage from commercial meter accounts. Corresponding information on the building area and parcel size was obtained from the City's Growth Database for parcels with active water usage. The unit sewage flow generation rate for the Faraday service, area based on the building size, was determined to be 0.39 gpm per 10,000 square feet of building area. This return rate of potable water to the sewer system from commercial meter accounts was approximately 94 percent. The return rate is considered to be high and is attributed to the fact that

irrigation water to this area is supplied through separate irrigation meters. Table 4-3 summarizes the results of the Faraday Industrial Flow Study.

Table 4-3
FARADAY INDUSTRIAL FLOW STUDY RESULTS

Total Lots in Faraday Lift Station Service Area	-	104 Lots
Total Lots with 8/01 water usage	-	82 Lots
Total Lot Area with 8/01 water usage	-	313 Acres
Total Building Area with 8/01 water usage	-	3,990,514 sqft
Average Building size	-	48,665 sqft/lot
Water supplied from commercial meters	-	7,377,524 gallons
Total Gallons of Sewage Pumped[(1)]	-	6,944,880 gallons
Return rate to sewer system (excluding irrig)	-	94%
Average flow rate of sewage pumped	-	156 gpm
Unit Wastewater Flow Rate (parcel based)	-	715 gpd/acre
Unit Wastewater Flow Rate (building based)	-	561 gpd/10,000 sqft
Unit Wastewater Flow Rate (building based)	-	0.39 gpm/10,000 sqft
Equivilent EDUs[(2)]	-	2.88 EDUs/10,000 sqft

(1) From Faraday Sewage Lift Station flow meter records
(2) Based on 220 gpd/EDU

4.6.2 Residential Unit Flows

To determine the average wastewater flow for residential customers, water meter records were obtained for parcels within the sewer service area and sorted based on the water meter type. Meter accounts that do not contribute to sewer flows (irrigation, agriculture, fire protection, and temporary meters) were first deducted from the data. For commercial, institutional, and multi-family accounts, the percentage of potable water entering the sewer system was assumed to be approximately 90 percent. These account types include newer meters similar to the accounts analyzed in the Faraday study (94 percent return rate), as well as older commercial meters that included some components of irrigation demand.

The return rate to the sewer system from single-family water meters is affected by the lot size and irrigation demands, and is highly variable. For this reason, water billing data from residential accounts was not used directly. Single-family meters and duplex meters were assigned an equivalent dwelling unit (EDU) of 1 and 2, respectively. To determine the flow per residential EDU, the total sewer flow estimated from non-residential and multi-family water accounts was deducted from the total sewer flow, based on the August 2001 Encina meter reading. The resulting residential flow component was then

divided by the total number of EDUs. Using this methodology, the average unit flow per residential unit for the existing Carlsbad sewer system is calculated to be approximately 195 gpd/EDU.

4.7 EXISTING FLOWS PER SUB-DRAINAGE BASIN

City of Carlsbad water billing records linked to the City's parcel base were used to determine the existing wastewater flow generation within each sub-drainage basin. Residential wastewater flows were estimated for each sub-drainage basin based on a unit flow generation rate of 195 gpd per single-family residential meter account (1 EDU), and 390 gpd per duplex meter account (2 EDUs). Wastewater flows from multi-family and non-residential parcels (multi-family, commercial and institutional meters) were estimated from water billing data using the assumed return rate to the sewer system of 90 percent. The estimated flows and EDU count for each sub-drainage basin are provided in Table 4-4. Sub-basin boundaries are illustrated on Exhibit 1 provided in Appendix A.

Table 4-4
EXISTING WASTEWATER FLOWS PER SUB-DRAINAGE BASIN

Sub-basin[1]	Interceptor System	No. of SF Units	Residential Flow[2] (gpm)	Non-Res. flow[3] (gpm)	Total flow (gpm)	Sub-basin[1]	Interceptor System	No. of SF Units	Residential Flow[2] (gpm)	Non-Res. flow[3] (gpm)	Total flow (gpm)
1A	V/C	153	20.72	92.25	112.96	6A	NB	498	67.43	45.06	112.49
1B	V/C	208	28.16	19.23	47.39	7A*	NAH	527	71.36	5.82	77.18
1C	V/C	118	15.98	0.00	15.98	7B	NAH	448	60.66	15.18	75.84
1D	V/C	428	57.95	81.35	139.30	7C*	NAH	383	51.86	0.00	51.86
1E	V/C	1,302	176.29	174.07	350.36	8*	NAH	133	18.01	0.00	18.01
1F	V/C	560	75.82	104.41	180.24	9	NB	513	69.46	107.69	177.15
1G	V/C	266	36.02	229.72	265.74	13A*	V/C	0	0.00	4.38	4.38
1H	V/C	606	82.05	119.35	201.41	13B	Vallecitos	0	0.00	113.01	113.01
1I	NAH	945	127.95	55.86	183.81	14B	NAH	1	0.14	3.28	3.42
1J	NAH	949	128.49	19.53	148.02	15B*	NAH	4	0.54	54.91	55.45
2A	V/C	583	78.94	67.97	146.91	18B	Vallecitos	951	128.77	28.71	157.48
2B*	NAH	223	30.19	0.00	30.19	19A	NB	414	56.06	4.94	60.99
2C	NAH	1,412	191.18	0.57	191.76	19B	NB	176	23.83	99.23	123.06
3A	V/C	244	33.04	145.86	178.90	19C	NB	400	54.16	6.15	60.31
3B	V/C	0	0.00	107.96	107.96	19D	NB	447	60.52	0.98	61.51
3C	Buena	0	0.00	41.24	41.24	20A	Vallecitos	556	75.28	4.05	79.33
4A	Buena	1,252	169.52	58.03	227.55	20B	Buena	291	39.40	1.01	40.41
4B	NB	857	116.04	12.42	128.46	20C	NB	221	29.92	0.00	29.92
5A*	NAH	0	0.00	4.91	4.91	20D	NB	92	12.46	0.00	12.46
5B*	Vallecitos	2	0.27	152.12	152.39	20E	NB	2	0.27	0.00	0.27
5C	Buena	0	0.00	23.44	23.44	21A	NB	138	18.69	1.95	20.63
5D*	NAH	0	0.00	10.99	10.99	21B	NB	82	11.10	9.91	21.01
5E	Buena	0	0.00	39.19	39.19	21C	Vallecitos	0	0.00	36.88	36.88
5F	Buena	0	0.00	14.13	14.13	22A	V/C	0	0.00	18.99	18.99
5G	Vallecitos	0	0.00	39.28	39.28	22B	NB	137	18.55	94.29	112.84
5I	Buena	0	0.00	105.15	105.15	24A*	NAH	233	31.55	0.00	31.55
5J	Buena	0	0.00	12.78	12.78	24B*	NAH	1	0.14	20.44	20.57
5K	Vallecitos	5	0.68	42.69	43.37						
Totals:		**16,761 SF Units**	**2,269 gpm Res. flow**		**2,451 gpm Non-Res. flow**					**4,721 gpm (6.8 MGD) Total Flow**	

(1) An asterisk denotes sub-basins that are currently discharging out-of-basin.
(2) Residential flow based on an average unit flow rate of 195 gallons per day per single family unit.
(3) Non-residential flow based on an assumed 90% return rate from commercial, institutional, and mult-family water billing records.

CHAPTER 5
EXISTING SYSTEM EVALUATION

The level of sewer service that is provided to a community is the result of the implementation of improvements that are "designed" in accordance with accepted criteria. The performance of a wastewater collection system and its components are evaluated based on comparisons with established and verified design criteria. This chapter describes the criteria, methodology and analyses used in the evaluation of interceptor facilities relative to 2001 conditions. The evaluation method employs the use of the *SewerCAD* hydraulic modeling software, which performs hydraulic calculations based on standard open channel flow algorithms and Manning's equation. *SewerCAD* performs extended period simulations (EPS) to route wastewater flows through the conveyance system using a unit hydrograph or diurnal curve. The result of this analysis technique is a more accurate depiction of the true peaking factor within the subject collection system. A summary of the performance of the existing system under both dry and wet weather conditions is provided.

5.1 DESIGN CRITERIA

Design criteria provide the standards against which the existing system is evaluated. These criteria are also the basis for planning of new facilities to improve existing service or to handle future wastewater flows. Most of the design criteria presented in this Master Plan Update conform to existing City of Carlsbad design standards and planning criteria. The most significant deviation from past standards and practices of the City occurs in the areas of wastewater flow projection methodology, discussed in Chapter 6 of this report, and peaking factor identification. Peaking factors used in the hydraulic analysis are based on historical dry and wet weather peak flows observed from metering data, as previously presented in Chapter 4.

5.1.1 Depth of Flow

Evaluation of gravity pipelines makes use of Manning's Equation for computation of a pipeline's capacity. The capacity of each gravity sewer is based on the relative depth of flow within the respective pipeline reach. Sewer interceptors are not typically designed to flow full, as unoccupied space at the top of the pipe is required for conveyance of sewage gasses and to provide contingent capacity for wet weather inflow and infiltration. Interceptor sizing is typically based on the pipeline flowing 75 percent full at the PWWF if the pipe is larger than 12-inches in diameter (D/d = 0.75). If the pipeline is 12-inches in diameter or smaller, a D/d factor of 0.50 is used.

5.1.2 Pipeline Friction Factor

Friction factors for pipelines vary with the material and the age of the pipe. For analysis purposes, the pipeline friction factor assumes that the pipeline has been in service for some period of time, and that some fouling, deposits, and deterioration may have occurred. A roughness factor as indicated by a Mannings' coefficient ("η") of 0.013 is typically used to evaluate existing interceptors and for projection of future sizing needs. Previous studies have shown that this value typically accounts for most pipe roughness, joints, and fouling that occur after several years of operation. At the direction of City staff, a Manning's coefficient of 0.012 was used in the evaluation of the PVC-lined RCP and CCFRPM pipeline sections of the V/C Interceptor installed in 2002 (reaches VC5 through VC11A).

5.1.3 Lift Stations

In the design of sewer lift stations, it is required that spare pumping units be included for mechanical reliability. A wastewater facility must be capable of conveying peak wet weather flows with the largest operating unit out of service. Lift stations are typically equipped with a minimum of two pumps and have a secondary or emergency power source, consisting of either installed generators or a connection for a portable generator. Forcemains are evaluated based on maintenance of a minimum or maximum allowable flow velocity, varying between 2.5 and 8.0 fps. Velocities less than 2.5 fps can result in deposition in the forcemain, while velocities greater than 8.0 fps can damage the pipeline through excessive abrasion.

5.2 EXISTING INTERCEPTOR SYSTEM HYDRAULIC MODEL

A new model of the Carlsbad interceptor system was developed from GIS data collected as apart of this Master Plan Update. The magnitude of external flows from agencies that contribute to the system and internal flow generation was determined from flow metering data. Information from City of Carlsbad water billing records was associated with the City's parcel base, and then used to distribute internal flows along the interceptor system. Peak dry and wet weather flows were input to the model using hydrographs (diurnal curves) developed from 24-hour metering data.

5.2.1 Physical Data Input

The existing Carlsbad interceptor model includes gravity pipelines, siphons, lift stations, and force mains comprising the V/C, NAH, Buena, Vallecitos and NB Interceptors, as shown on Exhibit 1, provided in Appendix A. Manhole locations, invert elevations, pipeline diameters, pipeline lengths, and other pertinent information were obtained directly from the sewer system GIS, developed as a part of this Master Plan Update, using a graphical interface and standard CADD/GIS software. The model consists of 374 pipeline segments totaling over 24 miles of pipeline. Pipeline diameters range from 8 to 54 inches. The interceptor reach naming convention established in the previous Master Plans has been maintained for this analysis.

In creating a model, there are often basic assumptions that are made to properly represent the system. Siphons in the Carlsbad interceptor system are typically double or triple barreled sections that may have different pipe sizes. The *SewerCAD* model requires that siphons be simplified by representing the section as a single pipe. An equivalent pipeline diameter was input for siphons based on the combined area of the pipes.

Pump curves, wet well dimensions and forcemains for the Buena Vista, North Agua Hedionda, Foxes Landing, Home Plant, and North Batiquitos Lift Stations are included in the model. Pumping units at lift stations can have either fixed speed or variable frequency drive (VFD) motors. Each of the lift stations modeled, with the exception of the North Batiquitos Lift Station, have VFD pumping units. With variable speed drives, the rate of flow coming into the station is essentially the same as the rate of flow out of the station. Lift stations with VFDs were modeled as a single design point pump. The North Batiquitos Lift Station has two duty pumps with fixed speed drives. Individual pumps and control settings were modeled for this lift station.

5.2.2 Internal Flow Distribution

Flow generation within Carlsbad is allocated and distributed to the interceptor system in accordance with the total flow generated within each sub-drainage basin. Sub-basin boundaries are illustrated on Exhibit 1 provided in Appendix A. City of Carlsbad water billing records and the City's parcel base were used to determine the existing wastewater flow generation within each sub-drainage basin. Residential wastewater flows were estimated based on a unit flow rate of 195 gpd per single-family residential meter account, and 390 gpd per duplex meter account (refer to Section 4.6 of this report). Wastewater flows from multi-family and non-residential parcels (commercial and institutional meter accounts) were estimated from water billing data using an assumed return rate to the sewer system of 90 percent. This return rate assumes that outdoor irrigation water for multi-family, commercial and institutional properties is delivered from separate irrigation meters. The estimated flows and EDU count per sub-drainage basin were previously provided in Table 4-4

The wastewater flows allocated to each sub-drainage basin were considered tributary to the pipeline interceptors at the corresponding discharge location of the trunk or collector sewers within that sub-basin. For sub-basins with multiple connection points to interceptor pipelines, flow was typically input at the upstream connection (a conservative evaluation approach). Table 5-1 summarizes the distribution of average flow within the system used for this analysis. The hydraulic analysis was performed by peaking the average flows, as discussed in the following section.

Table 5-1
EXISTING CARLSBAD FLOW SUMMARY BY INTERCEPTOR

Interceptor System	Single Family DU (1)		Com/Ind/Inst/MF Flow(3) (MGD)	Total Flow (MGD)
	No. of Units	Flow(2) (MGD)		
Vista/Carlsbad	4,468	0.87	1.68	2.55
North Agua Hedionda	5,259	1.03	0.28	1.30
Buena	1,543	0.30	0.42	0.73
Vallecitos	1,514	0.30	0.60	0.90
North Batiquitos	3,977	0.78	0.55	1.33
Totals:	**16,761**	**3.3**	**3.5**	**6.8**

(1) Includes townhomes and condos that receive an individual water bill
(2) Flow per SFDU is based on the overall calculated rate of 195 gpd/SFDU
(3) Sewer flow is estimated at 90% of the average water demand from 2001 billing records for multi-family, commercial and institutional accounts.

It is noted that the total flow rate of 6.8 MGD is slightly higher than the actual totals calculated for Carlsbad based on the August 2001 Encina meter records (refer to Table 4-3). The higher flow total is a result of using higher flows for the North Batiquitos Interceptor in the existing system analysis based on flow meter data from the North Batiquitos Lift Station. In addition, the distribution of flows using a universal flow rate of 195 gpd/SFDU resulted in an almost exact match with Encina meters in the Carlsbad/NAH interceptor system, but lower flows in the Buena and Vallecitos Interceptors. Higher peaking factors were therefore applied to the Buena and Vallecitos systems in the model to more closely match recorded peak flows. It is noted that future flow projections are based on a more conservative unit flow rate of 220 gpd/SFDU, as discussed later in Chapter 6 of this report.

5.2.3 Dry Weather Hydrographs

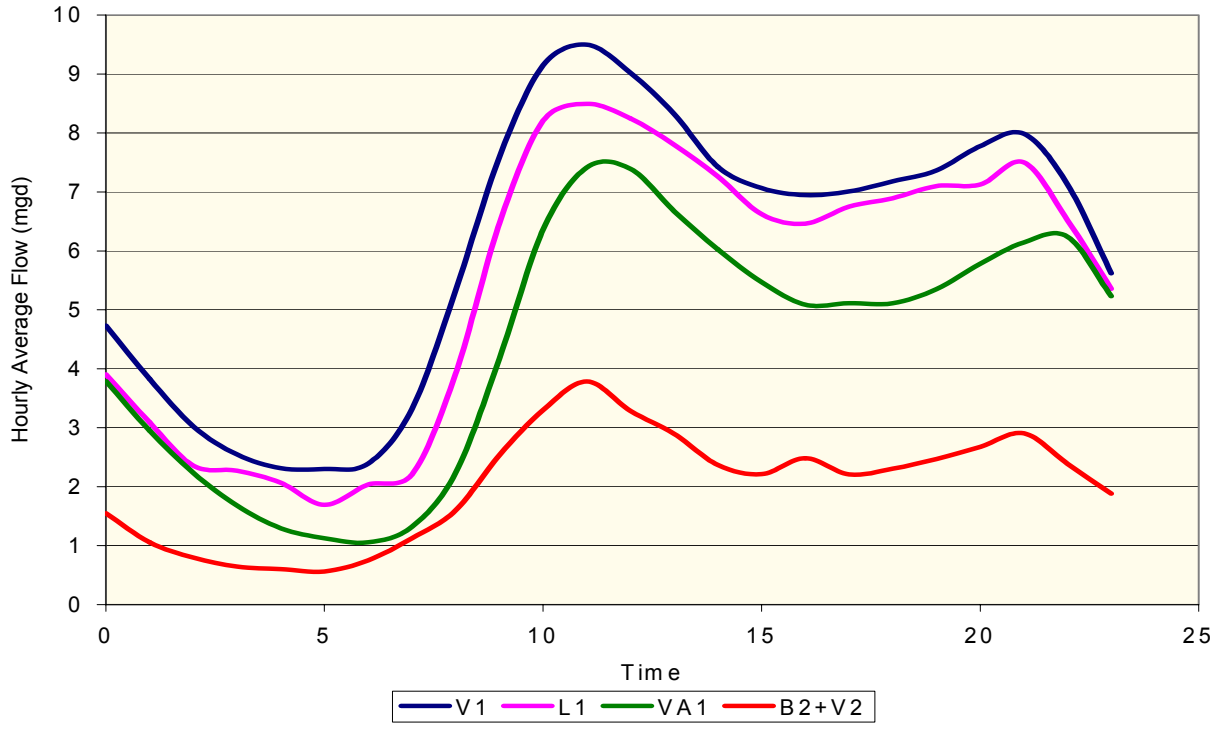
One of the primary differences between the analyses performed in the previous Master Plans and this Master Plan Update is the use of unit hydrographs or "diurnal curves" as opposed to fixed peaking factors for the determination of peak dry weather flows. Hydrographs are developed to account for the varying rate of wastewater production throughout a typical day. The term "diurnal" is indicative of the shape of the curve, which typically exhibits peak flow periods twice in a 24-hour period. The use of diurnal curves when accounting for the wastewater production of each contributor allows for a more accurate representation of flow variations and accounts for the routing of wastewater through the collection system on a temporal basis.

Dry weather hydrographs were developed for each upstream contributing agency and for the internally generated Carlsbad flows based on flow meter data collected and reviewed from Encina meters. From the

graphs in Appendix C, it is clear that the shapes of the unit hydrographs for each basin are similar. However, each basin exhibits its own unique peaking factor based on the combination of land uses that comprise the basin. Hydrographs for the existing system model were based on flow data from Sunday, August 26. As discussed previously in Chapter 4, weekend peaks were observed to be higher than weekday peaks, and the highest peak flows in most interceptors during August 2001 occurred on August 26. The dry weather hydrographs generated from the model at the downstream interceptor reaches were then compared to hydrographs from meters near the Encina WPCF to assure that the model accurately reflected the collection system flows.

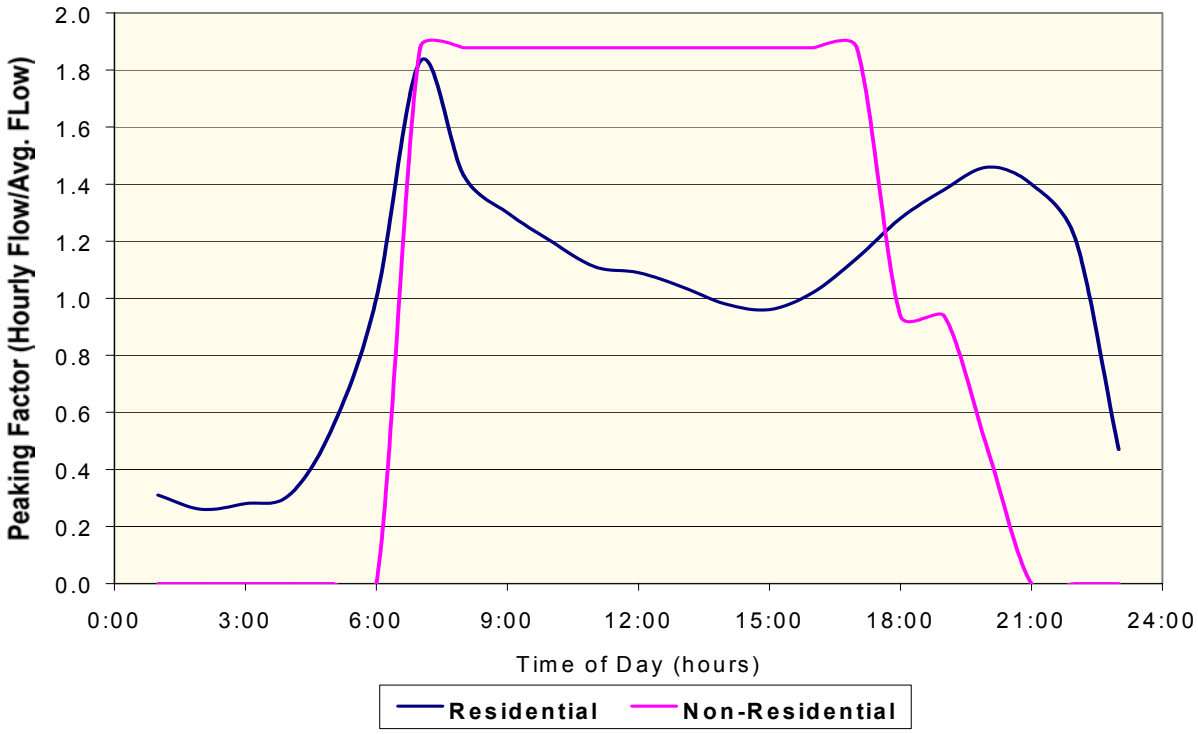
Wastewater flows tributary to the Carlsbad system from other agencies are termed "external loads". At each major connection to the Carlsbad system, flow meters are installed for billing purposes. The 24-hour flow data from each of these meters was analyzed and used to determine the existing dry weather flow entering the system. Figure 5-1 illustrates the dry weather hydrographs developed for external loads to the Carlsbad system. The hydrographs represent City of Vista flows to the V/C Interceptor (V1), Buena and Raceway Lift Station flows to the Buena Interceptor (B2 + V2), Vallecitos flows to the Vallecitos Interceptor (VA1), and Leucadia and Encinitas flows to the NB Interceptor (L1). Dry weather peaking factors for the upstream agency flows based on these graphs range from 1.63 for the City of Vista to 1.85 from the Buena and Raceway lift stations.

Figure 5-1
DRY WEATHER HYDROGRAPHS FOR EXTERNAL LOADS



The diurnal curves developed for internal loads to each of the interceptors were normalized into "unit" diurnal curves. Two separate curves were developed based on the flow type. The diurnal pattern for the Carlsbad single family residential flows was developed by consideration of each of the measured flows within the system. The "non-residential" flow pattern was based on previously developed curves for the Southern California region. Figure 5-2 illustrates the diurnal patterns applied to average Carlsbad flows generated within each sub-drainage basin.

Figure 5-2
DRY WEATHER UNIT HYDROGRAPHS FOR INTERNAL LOADS



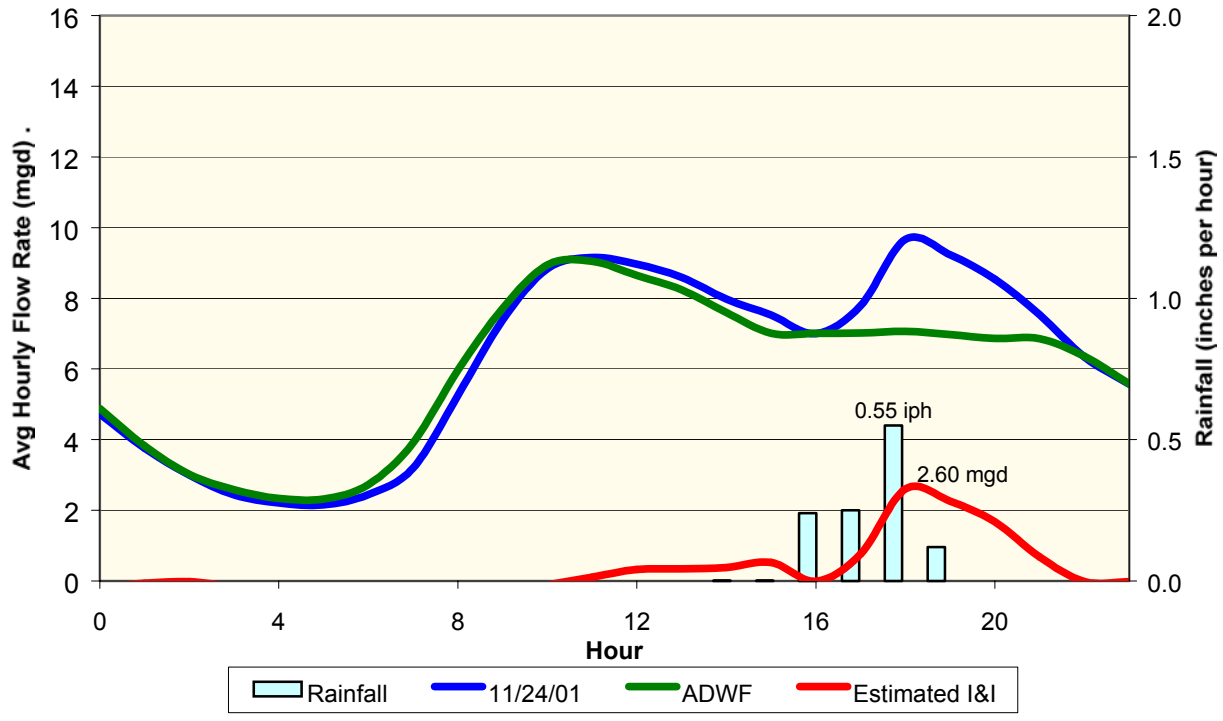
5.2.4 Wet Weather Flows

To understand the operations of the existing system during peak flow periods, wet weather flows (from inflow and infiltration) are added to the dry weather flows. This section discusses the methods used to model wet weather flow events. Long term flow metering data was reviewed to determine the wet weather response of each interceptor system. Five storm events were reviewed and a single storm was selected to represent wet weather flows in the system. The largest event occurred on February 22 and 23, 1998. This single event had a rainfall total of over 2.2 inches. Several million dollars of damages occurred in the surrounding area according to the National Weather Service. Because of the extreme nature of this event and the questionable nature of meter and rain gauge operations, this event was not considered for further analysis.

The storm event selected for the wet weather analysis occurred on November 24, 2001. The total rainfall amount for this storm was 1.29 inches with a peak intensity of 0.55 inches/hour. The rainfall occurred during an off-peak flow period and lasted for approximately 4 hours. The fact that it occurred off-peak allowed more accurate flow measurement of flows entering the system. Because this rainfall event was not preceded by other storms, it provides a good representation of the inflow component of flow. The inflow component of rainfall induced I&I produces the highest peak flows in a system. However, storm water induced infiltration can also increase peak flows. This is evident in the flows from the City of Vista to the Vista/Carlsbad (V/C) Interceptor.

To illustrate the use of hydrographs for wet weather events, the development of flow curves for the City of Vista based on Encina flow meter V1 is presented. The inflow component of I&I, or the "defect" flow, was derived by comparing the peak flow rate of the wet weather event to the average dry weather flow. This flow curve comparison is presented on Figure 5-3. From Figure 5-3, it is apparent that there was an additional 2.6 MGD of wastewater flow as the result of the peak intensity of the storm (0.55 inches of rainfall per hour).

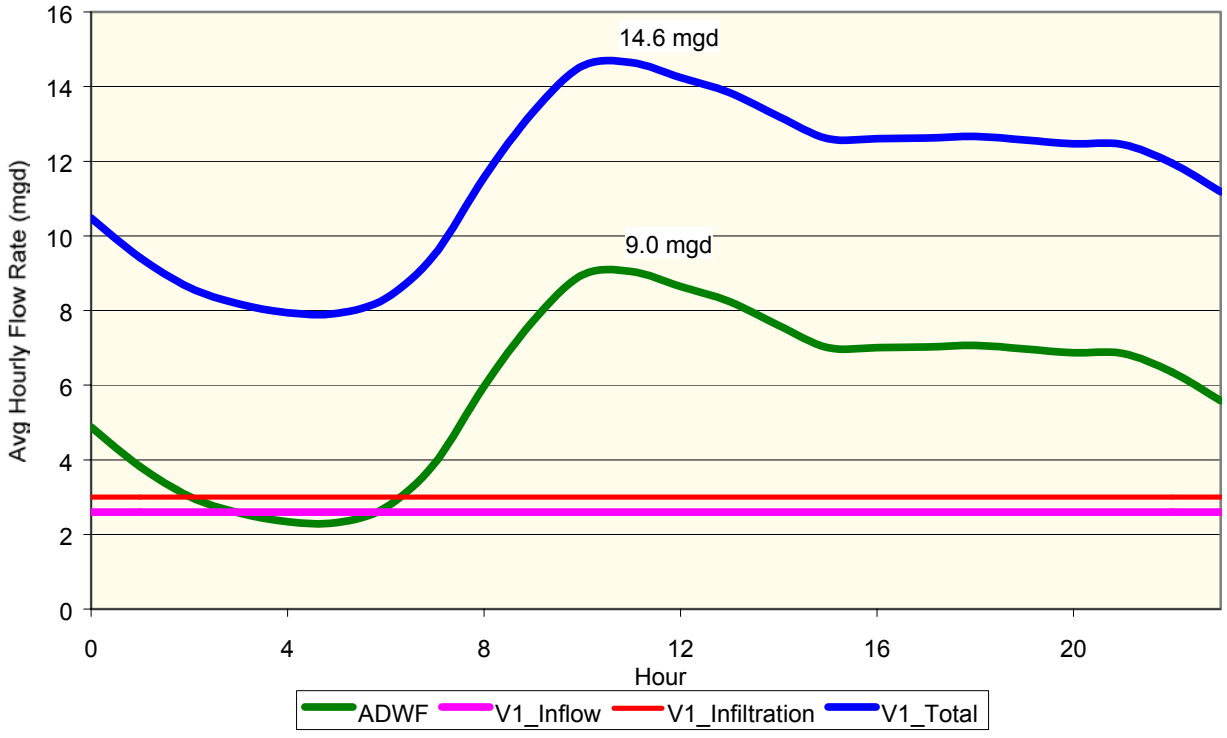
Figure 5-3
I&I FLOW ANALYSIS FOR THE VISTA METER (V1) ON 11/24/01



The City of Vista has exhibited long-term flow response from increased infiltration due to high ground water levels following major storm events. Based on flow data documented in the July 2001 City of Vista Wastewater Master Plan Update, an additional base infiltration load of approximately 3.0 MGD has been experienced for extended periods after storm events due to high ground water levels and pipeline defects. This infiltration rate was added to the calculated peak inflow rate of 2.6 MGD. The total defect flow representing peak I&I rates assigned to the Vista system is therefore 5.6 MGD.

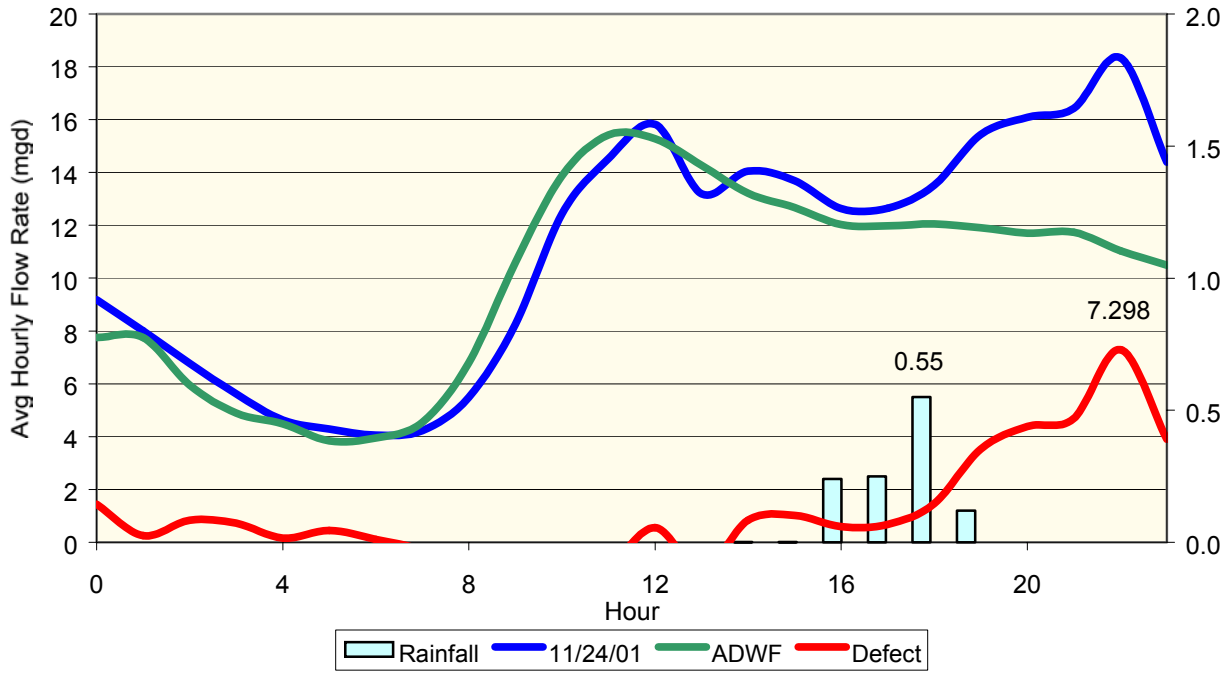
With an average dry weather peak flow rate of just over 9.0 MGD, the predicted peak wet weather flow rate for the existing City of Vista system tributary to the V/C Interceptor is approximately 14.6 MGD (9.0 MGD + 5.6 MGD). Using a "fixed pattern", as illustrated on Figure 5-4, assures that the peak of the sanitary flow and the defect flows are additive. The peak flow response is what would be predicted if the same rainfall amount and intensity of the November 24, 2001 storm event occurred coincidental with the peak dry weather flow during a period of elevated ground groundwater levels (due to a previous storm or series of storms).

Figure 5-4
POTENTIAL PEAK WET WEATHER FLOWS TO THE V/C INTERCEPTOR FROM VISTA



The City of Carlsbad system also contributes I&I to the V/C Interceptor. The combined flow from Vista and Carlsbad tributary to the V/C and NAH Interceptors is measured at the C3 Encina meter, which is just upstream of the Encina WPCF. The effects of the November 24, 2001 storm event at this site are shown on Figure 5-5.

Figure 5-5
I&I FLOW ANALYSIS FOR THE V/C METER AT ENCINA (C3) ON 11/24/01



As shown on Figure 5-5, the total peak defect flow on November 24, 2001 was approximately 7.3 MGD. The contribution from Vista for this event was previously calculated to be approximately 2.6 MGD. The increase in defect flow from the City of Carlsbad to the V/C and NAH Interceptors is therefore calculated to be approximately 4.7 MGD. Without detailed flow studies and additional monitoring it cannot be accurately determined where the storm water is entering the system. The internal stormwater inflow for Carlsbad was distributed evenly in the model along the entire length of the V/C Interceptor. This assumes a bias towards wet weather flow contributions occurring in the V/C Interceptor rather than the NAH Interceptor. It is noted that the flow meter at Foxes Lift Station on the NAH Interceptor is not currently operational. This meter is recommended to be repaired to provide a long-term historical record of wet and dry weather conditions for this interceptor.

Peak wet weather flow curves were developed based on observed inflow rates from November 24, 2001 meter data for the Buena, Vallecitos and North Batiquitos Interceptors in a similar manner. For the Vallecitos and NB Interceptors, the measured I&I during wet weather flow events from upstream sewering agencies was higher than defect flows recorded at downstream meters at Encina. For these interceptors, I&I was therefore attributed to the Vallecitos and Leucadia/Encinitas systems, respectively. In the Buena Interceptor, the peak

I&I rate was calculated from the upstream agency and a measurable amount of inflow was determined to be generated within Carlsbad. The internal defect flow for this interceptor was applied to the upstream end of the interceptor in the hydraulic model. Table 5-2 summarizes the I&I applied in the existing system wet weather analysis.

Table 5-2
EXISTING SYSTEM ANALYSIS PEAK I&I RATES

Model ID	Description	Flow Rate (MGD)
V1	City of Vista External Inflow	2.6
272	City of Vista External Infiltration	3.0
VC_IntWx	Carlsbad Internal I&I to V/C	4.7
B2_V2	Buena/Raceway External I&I	1.1
437	Carlsbad Internal I&I to Buena	0.5
VA1	Vallecitos External I&I	3.5
L1	Leucadia External I&I	2.1
	TOTAL ESTIMATED I&I	**17.4**

5.3 CAPACITY ANALYSIS RESULTS

This section discusses the results of the hydraulic analyses conducted with respect to the existing system, which includes improvements to the V/C Interceptor that are currently under construction. An understanding of the hydraulic condition of the existing system is necessary to identify existing system deficiencies, and to help prioritize recommended system improvements resulting from the ultimate system analysis. The capacity of the interceptor system was evaluated under both dry and wet weather flow scenarios.

5.3.1 Gravity Pipelines

Capacity analysis of open channel systems is generally based on the consideration of the depth of flow as compared to the diameter of the pipe (D/d). For the interceptor system, this depth to diameter ratio is constrained to not exceed 0.75 for peak dry weather conditions. It is also considered undesirable to operate the system at depths over 90 percent of the diameter under peak wet weather conditions. Exceptions to these guidelines are allowed when considering siphons or other known areas of pressure flow.

The capacity analysis under dry weather flow conditions indicates that two flat pipeline reaches in VC14 and VC15 are flowing full (refer to Section 3.2.1). There are a few isolated locations where flows exceed the 75 percent full criteria in the Buena Interceptor, also due to short sections of very flat pipeline. These areas are minor and are not considered to be worthy of further discussion.

Based on analysis of the existing collection system with wet weather flows, several gravity pipelines were determined to be deficient with respect to the design criteria established in Section 5.1 of this Master Plan Update. It is noted that the peak wet weather event modeled is conservatively based on potential flows and I&I rates that could occur, and is not based on actual recorded flows. The potentially deficient pipeline reaches identified during the existing system analyses are located within four separate areas of the interceptor system, as documented in Table 5-3.

Table 5-3
EXISTING PWWF ANALYSIS SUMMARY FOR GRAVITY PIPELINES

Model ID	Reach	Length (ft.)	Diam. (ft.)	Location/Comments
274-281	VC3	2,830	36	Approach to Buena Vista Lift Station - pipeline flowing 75% full
309-310	VC11	896	42	Approach to Agua Hedionda Lift station - localized surcharging
300-307	VC13	3,510	42	Downstream of Agua Hedionda Lift Station - pipeline capacity is exceeded for short periods; two very flat sections (reaches 290 and 288) and one short 20' pipe with neg. slope (reach 287)
290-298	VC14	4,530	42	
283-289	VC15	1,860	42	
194	B4	594	18	Upper Buena, localized surcharging in very flat reach
1	B7	596	24	Lower Buena, localized surcharging in very flat reach
392	B8	208	30	Lower Buena, isolated flat sections
377	B8	93	30	

The longest sections of pipeline in this table are in the Vista/Carlsbad Interceptor in Reach VC-3, which is upstream of the Buena Vista Lift Station, and Reaches VC-13-15, which are downstream of the Agua Hedionda Lift Station. These pipeline reaches are planned for future capacity upgrades, and the replacement pipelines are sized based on ultimate flows in the next chapter of this report. The other two areas with existing capacity deficiencies are short sections of pipeline in the upstream and extreme downstream reaches of the Buena Interceptor. These pipelines are flowing full as a result of isolated pipelines with very flat slopes (refer to Figure 3-4).

5.3.2 Lift Stations

Lift station facilities within the sewer interceptor system were evaluated by comparing the peak influent wastewater volume to the lift station's "firm" pumping capacity, as documented previously in Table 3-4. The influent wastewater volume of the pump station is defined by the wastewater flowing in the pipeline(s) just upstream of each lift station in the hydraulic model. As discussed in Chapter 3, lift stations are generally designed to maintain a "firm" capacity equal to or greater than the projected peak design flow at a specific point in time.

Table 5-4 summarizes the peak flow tributary to the lift stations and the peak forcemain velocities exhibited based on those flows. Estimates of peak wet weather flows are provided for the V/C Interceptor, but only peak dry weather flows are calculated for the NAH and NB Interceptors due to a lack of wet weather flow monitoring data.

Table 5-4
POTENTIAL PEAK FLOWS TO INTERCEPTOR LIFT STATIONS

Lift Station	Lift Station Firm Capacity (MGD)	PDWF to Wet Well (MGD)	PWWF to Wet Well (MGD)	Peak Velocity in Force Main[1] (fps)
Buena Vista	21.5	10.2	18.9	6.9 [2]
Agua Hedionda	23.0	15.3	24.2	10.6
Foxes Landing	3.7	2.24	---[3]	4.4
North Batiquitos	3.2	1.47	---[3]	2.6

(1) Velocity is based on the peak influent flow to the station for variable speed pumps. For the NB Lift Station (fixed speed), the velocity is based on the output of a single pump.
(2) Peak velocity in the parallel 16" & 24" section. Velocity is 9.3 fps in the short, single 24" section and 10.5 fps in the parallel 16" section in the bridge over I-5
(3) Metering data to determine wet weather flows is not available for this system

Based on the data in Table 5-4, there is approximately 1.7 MGD of available pumping capacity at the North Batiquitos Lift Station to convey stormwater flows. In the hydraulic model simulation, only one fixed-speed pump operates at the North Batiquitos Lift Station at a discharge rate of approximately 1,200 gpm (1.7 MGD). System operators have stated that a second pump has never needed to operate at the North Batiquitos Lift Station in response to peak flows during a storm. It can therefore be concluded that the North Batiquitos Lift Station has sufficient capacity for current wet weather flow conditions.

Based on the PDWF to the Foxes Landing Lift Station, there is approximately 1.4 MGD of available pumping capacity to convey stormwater flows. The downstream reaches of the AH Interceptor are along the north shore of the Agua Hedionda Lagoon, and are potential sources of I&I to the interceptor system with rising water levels in the lagoon. Wet weather flow data is needed to estimate the existing I&I rate to this system, and to determine if there is sufficient available capacity at the lift station to convey peak wet weather flows.

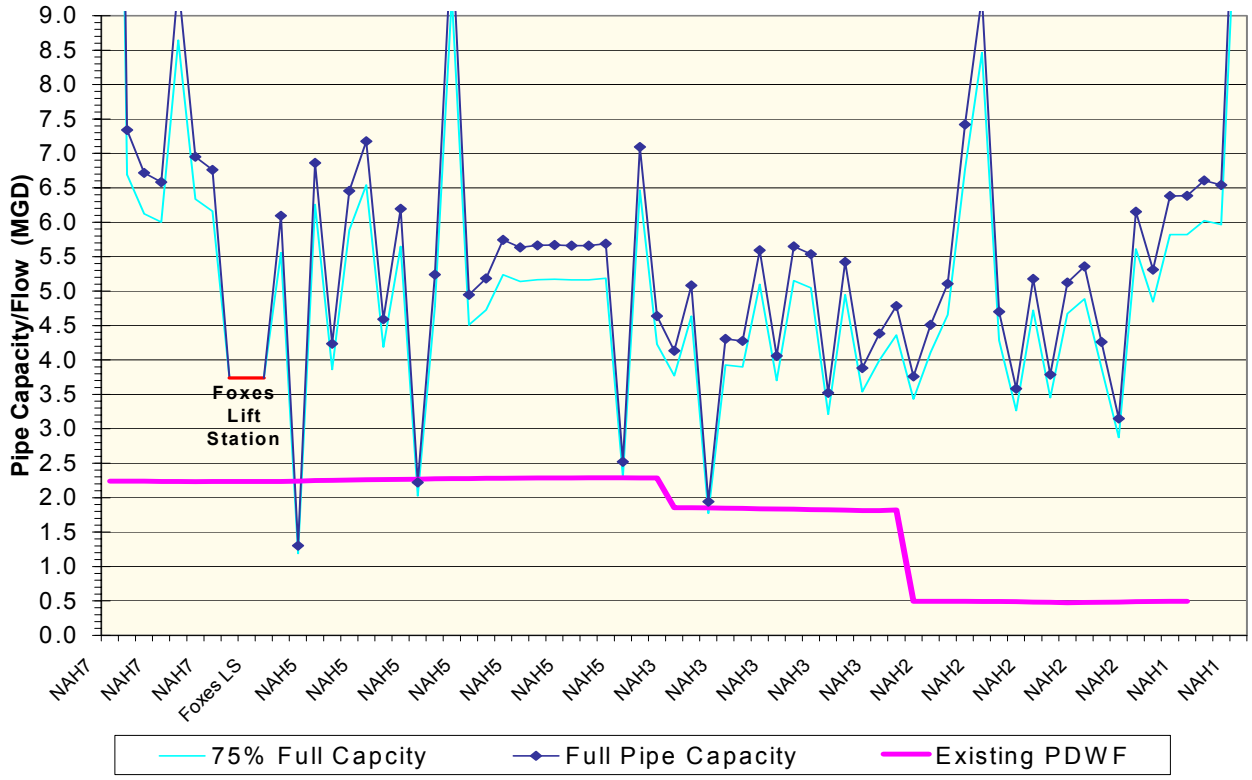
For the V/C Interceptor a hydraulic analysis of peak wet weather flows was performed. Results indicate that the Buena Vista Lift Station may be potentially operating near its firm capacity during severe storm events, and the capacity of the Agua Hedionda Lift Station could potentially be exceeded for brief periods. Velocities in the Agua Hedionda forcemain and portions of the Buena Vista forcemain are also exceeding the recommended maximum velocity of 8.0 fps during peak wet weather flow conditions.

5.3.3 North Agua Hedionda Interceptor

The North Agua Hedionda Interceptor currently conveys flows that will ultimately discharge to the South Agua Hedionda Interceptor (Sub-basins 5A, 5D, 7C, 8, 15B, 24A and 24B) and the Vista/Carlsbad Interceptor (Sub-basins 2B and 7A). Consequently, ultimate flows for this interceptor are projected to be considerably less than existing flows. A capacity analysis of this interceptor was therefore performed with existing flows to determine the available capacity and estimate the number of future EDUs that the North Agua Hedionda Interceptor can serve.

Encina meter data indicates that there is a significant volume of I&I generated by Carlsbad (internal defect flows) within the V/C and NAH Interceptor systems. The amount of I&I attributed to each interceptor is unknown because the flow meter at the Foxes Lift Station is not operational. Additionally, wet weather flow monitoring studies performed in 2001 did not provide information on I&I rates due to a lack of significant rainfall during the monitoring period. In the hydraulic model, the measured internal defect flows are allocated to the upstream end of the V/C Interceptor and the capacity analysis for the North Agua Interceptor is performed with peak dry weather flows. Figure 5-6 summarizes the results of this analysis.

Figure 5-6
NAH INTERCEPTOR HYDRAULIC ANALYSIS SUMMARY



The chart in Figure 5-6 illustrates the maximum flow rate in each reach of the interceptor over the 24-hour hydraulic simulation, and provides a comparison with pipeline and lift station capacities. The peak dry weather flow line represents a composite flow from the analysis results, as the peak flow in each reach may occur at different time steps in the simulation. As can be seen on Figure 5-6, there are four isolated reaches of pipeline in the NAH Interceptor that have significantly reduced capacities. These reaches are 24-inch diameter pipelines with slopes of 0.03 percent or less, and lengths that vary between 126 and 283 feet. Analysis results indicate that these reaches may be currently surcharging for very brief periods with peak dry weather flows. If the isolated pipelines are allowed to surcharge for brief periods, the available capacity in the NAH Interceptor system is limited by the capacity of the Foxes Lift Station, and not the gravity pipelines.

There is currently no way to accurately estimate peak storm water flows in the NAH Interceptor system. Considering the proximity of the gravity sewers to the lagoon, however, there is a significant potential for high I&I rates. To estimate the PWWF, a peaking factor of 3.0 was initially applied to the ADWF in this system. With a peaking factor of 3.0 applied to the ADWF of 1.3 MGD in the NAH service area, the resulting estimate of PWWF is 3.9 MGD. This flow is higher than current capacity of the Foxes Lift Station. It is concluded that the amount of additional capacity is this system cannot be estimated without additional wet weather flow data.

5.3.4 Inter-Agency Pipeline Flows

Peak wastewater flows in gravity pipelines that are jointly-owned with other sewer agencies are compared to design flows and Carlsbad capacity rights as defined in existing agreements.

Occidental Sewer. The Occidental Sewer is jointly-owned by the City of Carlsbad, the ESD, and the LCWD. The capacity of the 39-inch diameter gravity pipeline flowing 75 percent full is approximately 19.2 MGD. Hydraulic analysis results indicate a potential PWWF of 12.5 MGD in this pipeline. Carlsbad owns a total of 40.0 percent of the available capacity, or approximately 8.5 MGD. Peak dry weather flows from Carlsbad are effected by of the operation of the upstream North Batiquitos Lift Station, and are currently estimated at 2.3 MGD. This value is based on one pump operating at the NB Lift Station. Existing I&I from Carlsbad to the NB Interceptor has not been sufficient enough to cause a second pump to operate, and therefore is not effecting peak flows in the Occidental Sewer. The City of Carlsbad is therefore using less than 30% its allocated capacity in the Occidental Sewer.

Vallecitos Interceptor. Hydraulic analysis results indicate that the PWWF in the Vallecitos Interceptor is 12.7 MGD. The capacity of the interceptor is listed as 20.85 MGD in the 1985 agreement with the VWD (formerly the San Marcos County Water District), which is based on the pipeline flowing full. Carlsbad has capacity rights of 5.0 MGD based on peak flow rates to the Vallecitos Interceptor. The PDWF from Carlsbad in the Vallecitos Interceptor is estimated at slightly less than 2.0 MGD based on Encina meter data and the peaking curves on Figure 5-2. The estimated defect flows resulting from I&I on November 24, 2001 were higher at the upstream end of the interceptor (meter VA1) than at the downstream end (meter C1). Therefore,

I&I in the Vallecitos Interceptor is attributed to flows from Vallecitos in the hydraulic analysis, and it can be concluded that storm water inflow to this interceptor from the Carlsbad service area is minimal. It is estimated that Carlsbad is currently using less than half of its leased flow capacity in the Vallecitos Interceptor.

Buena Interceptor In the existing system model, the total PWWF in the Buena Interceptor at the downstream reach was calculated to be 4.7 MGD. Most of the gravity reaches in this interceptor have a full flow capacity between 6.0 and 7.0 MGD. However, there are several shallow sloped pipelines that the model indicates are surcharging (conveying flows higher than the full pipe capacity) during peak wet weather flow conditions. Analysis results indicated that two of these pipelines may be surcharging briefly under PDWF conditions as well. PWWF from the City of Carlsbad is estimated to be approximately 2.2 MGD, which includes an allocation of 0.5 MGD for the peak I&I rate (refer to Section 5.2.4 and Table 5-2). It is estimated that Carlsbad has less than 0.5 MGD of available capacity in this pipeline based on existing capacity rights. It is noted that the discharge rate to the Buena Interceptor from the BSD Buena Lift Station can be highly variable. The Buena Lift Station shares a common wet well with the influent lift station to the Shadowridge WWTP. During peak flow periods and periods of high rainfall, a portion of the flow from the Buena drainage basin is diverted to Shadowridge WWTP to prevent surcharging of the Buena Interceptor.

5.3.5 Flows to the Encina WPCF and Outfall

Evaluation of Carlsbad's use of the Encina wastewater treatment facility is based on the average dry weather flow for treatment plant capacity and the peak wet weather flow for capacity in the ocean outfall. As summarized in Chapter 4 of this report, the existing wastewater flow for Carlsbad, based on meter records for August 2001, is approximately 6.5 MGD. A slightly higher flow rate of 6.8 MGD was used for the existing system hydraulic analysis. Compared to existing capacity rights of 9.24 MGD for treatment and solids handling, the City of Carlsbad is currently using less than 74 percent of its capacity ownership in the Encina WPCF.

The Encina Ocean Outfall has a maximum instantaneous capacity of 104.9 MGD, considering the capacity enhancement of constructed flow equalization facilities. Carlsbad's capacity rights in the outfall are 25.51 MGD, which is based on a peaking factor of 2.76 times the ADWF. Peak flow rates from Carlsbad cannot be determined from flow meter data since Carlsbad flows are subtracted from other agency flows. Resultant peak flows from Carlsbad at Encina are likewise not available from the hydraulic analysis. Based on the peaking factor curve presented on Figure 4-5, the PDWF from Carlsbad is estimated to be 1.7 times the ADWF, or approximately 11.5 MGD. Approximately 5.2 MGD of I&I was attributed to Carlsbad and added to Carlsbad flows in the wet weather hydraulic analysis. The estimate of PWWF from Carlsbad to Encina is, therefore, 16.7 MGD, which is approximately 2.5 times the ADWF. It is therefore estimated that the City of Carlsbad is currently using approximately 65 percent of its capacity ownership in the Encina Ocean Outfall.

CHAPTER 6
ULTIMATE SYSTEM FLOW PROJECTIONS AND ANALYSIS

Future flow projections are used to determine required upgrades to the existing collection system to adequately serve Carlsbad's wastewater conveyance needs under "buildout" conditions. The existing interceptor system, with the addition of the South Agua Hedionda Interceptor and incorporation of planned improvements to the collection system, was analyzed with projected peak ultimate flows to identify and size required improvements. For this Master Plan Update, a flow projection methodology consistent with the Carlsbad Growth Database was developed. Ultimate wastewater flows were computed based on the projected number of single family units, multi-family units, and non-residential building area tributary to the wastewater collection system and the established unit flow factors. Results of the analysis are summarized and deficiencies identified. Recommended improvements to the sewer interceptor system to convey ultimate flows are presented in Chapter 7 of this report.

6.1 PLANNED SEWER SYSTEM IMPROVEMENTS

The City of Carlsbad ultimate sewer system will include the four existing interceptors and the future South Agua Hedionda (SAH) Interceptor. The assignment of ultimate flows to the interceptor system is made with the assumption of several future changes to the collection system, which were dicussed and verifed with City Staff. Exhibit 2, provided in Appendix A, illustrates the proposed ultimate sewer interceptor system that was analyzed in this Master Plan Update. This map also identifies the interceptor system to which each sub-drainage basin will ultimately discharge.

6.1.1 South Aqua Hedionda Interceptor

The SAH Interceptor will serve areas south and east of the Agua Hedionda Lagoon, and connect with the V/C Interceptor between reaches VC13 and VC14. The interceptor will convey City of Carlsbad flows only. Previous planning studies for the SAH Interceptor included flow contributions from the City of Vista Raceway Basin and the City of Oceanside's Leisure Area and Lake Lift Station. The City of Vista has recently confirmed that they are no longer interested in discharging flows to the SAH Interceptor. The conveyance of flows from Oceanside are no longer feasible because the eastern portion of Sub-basin 15A, which was previously planned for development and included a sewer extension east to Oceanside, has now been designated as open space. The SAH Interceptor will serve Sub-basins 5A, 5B, 5D, 7C, 8, 13A, 14A, 15A, 15B, 16, 18A, 24A, and 24B. A new lift station and an approximate one-mile long forcemain will be included in the SAH Interceptor system.

Figure 6-1 illustrates the alignment and reach designations of the SAH Interceptor. The eastern portion of the SAH Interceptor, along Sunny Creek Road and El Camino Real south of Cannon Road, has already been constructed. This portion of the interceptor is currently tributary to the NAH Interceptor. Another portion of the interceptor in Cannon Road, west of El Camino Real, has also been constructed, and the Kelly Ranch Lift Station now lifts flow from that pipeline into the NAH Interceptor. The remaining portions of the SAH Interceptor, yet to be constructed, include the SAH Lift Station and forcemain. A new gravity sewer will connect with the gravity line from the Faraday Business Park and discharge to the SAH Lift Station. When the SAH Interceptor is complete, the Kelly Ranch Lift Station and both Faraday Lift Stations will be abandoned.

6.1.2 Collector System Improvements

An expansion of the existing collector system will be required to connect future developments with existing pipelines and interceptors. The size and alignment of these future collection pipelines are not analyzed in this Master Plan Update. However, the discharge locations to the interceptors are identified for the hydraulic analysis of the ultimate interceptor system. The assumed general alignments of these major future collection sewers, future lift stations, and forcemains are shown on Exhibit 2.

A new lift station will be required to convey flows from Sub-basins 16 and 18A to the SAH Interceptor. Flows from several sub-basins are currently being pumped "out-of-basin", and future gravity sewers are planned that will eliminate some existing lift stations. The lift stations planned for elimination include:

- Vancouver Lift Station - A gravity pipeline through LFMZ 25 will convey flows from Sub-basin 2B to the V/C Interceptor. Flows are currently pumped to the NAH Interceptor.

- Simsbury Lift Station - A gravity pipeline through LFMZ 25 will connect with a future gravity pipeline from the Vancouver Lift Station and convey flows from Sub-basin 7A to the V/C Interceptor. Flows are currently pumped to the NAH Interceptor.

- Villas Lift Station - A gravity pipeline will extend north from the existing lift station in a future easement and connect with the future gravity line from the Simsbury Lift Station through LFMZ 25 to the V/C Interceptor. Flows from the Villas Lift Station, which serves several apartment complexes, are currently pumped to the NAH Interceptor.

- Woodstock Lift Station - Flows from the approximately 20 single family residences served from the Woodstock Lift Station will be conveyed by gravity through the future Calavera Hills development in Sub-basin 7C to the SAH Interceptor. Flows are currently pumped to the NAH Interceptor.

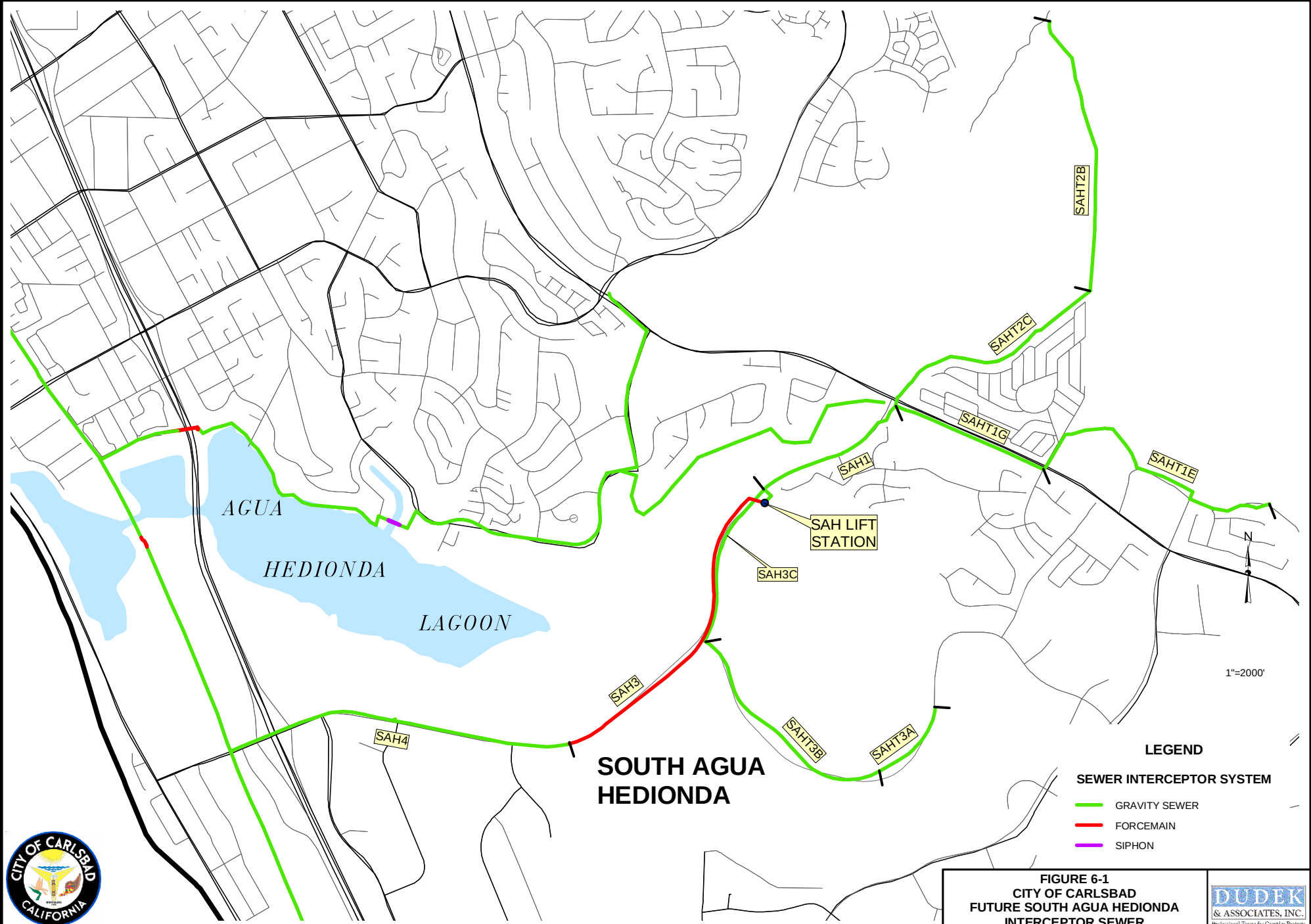


FIGURE 6-1
CITY OF CARLSBAD
FUTURE SOUTH AGUA HEDIONDA
INTERCEPTOR SEWER

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- Gateshead Lift Station - Flows from the approximately 25 single family residences served from the Gateshead Lift Station will be conveyed by gravity through the future Robertson Ranch development in Sub-basin 14A to the SAH Interceptor. Flows are currently pumped to the NAH Interceptor.

- Faraday Lift Stations No. 1 and 2 - A gravity pipeline will extend from Faraday Lift Station No. 2 to the SAH Interceptor, and discharge just upstream of the future SAH Lift station. Most of this pipeline has already been constructed. Flows from Sub-basin 5B are currently pumped to the Vallecitos Interceptor.

- Kelly Ranch Lift Station – This temporary lift station will be replaced by the SAH Lift Station. Flows from Sub-basin 8 are currently pumped to the NAH Interceptor.

- La Golondrina Lift Station - The Golondrina Lift Station currently pumps City of Carlsbad flows in Sub-basin 6B to the LCWD. A future gravity pipeline will convey flows from the Golondrina service area to the Poinsettia Lift Station and Vallecitos Interceptor. This pipeline is also planned to collect flows from a small area in the southwest corner of Sub-basin 18B, which currently discharges to the LCWD.

- Forest Lift Station – A gravity pipeline constructed using a micro-tunneling construction process will convey flows from Sub-basin 1C to the V/C Interceptor upstream of the Buena Vista Lift Station. Flows are currently pumped to the V/C interceptor downstream of the Buena Vista Lift Station.

6.2 CARLSBAD GROWTH DATABASE

Build-out projections for the City of Carlsbad have been recently updated and compiled into a Growth Database, which is maintained by the City. Growth projections are based on current development plans and results of the 2000 Census. The City of Carlsbad Growth Database is parcel-based and includes information on existing land use, as well as growth potential. Growth data provided in the database consists of the number of projected single family units, multi-family units, and the estimated building area for non-residential land use at build-out. The building area in the database is generally assumed at 25 percent of the parcel size, unless more detailed planning information was available

Over half of the projected growth in the City of Carlsbad sewer service area is associated with known, planned developments in the eastern portion of the City. These developments include Kelly Ranch, Villages of La Costa, Calavera Hills, Mandana Properties, and Robertson Ranch, which are primarily residential developments, the Carlsbad Oaks North and Faraday Business Parks, and Bressi Ranch, which will have a mixed-land use. Development information for these large planned projects is typically lumped onto a single existing parcel in the Growth Database, even if the project boundary encompasses

several existing parcels or drainage sub-basins. Layout maps in various development stages were provided by the City for most of these projects and used to distribute the projected sewer flow to appropriate sub-basins. The remainder of future growth in the City of Carlsbad is projected to include smaller, non-specific developments and general "infill" of established neighborhoods and commercial areas located in the western portions of the City.

The Growth Database was originally provided by the City of Carlsbad at the start of the Master Plan Update project. During the course of the project, several updates to the projected future growth were provided by the City and incorporated into a modified database. The growth potential data in the City of Carlsbad Growth Database used for this Maser Plan Update is summarized by Local Facility Management Zone (LFMZ) in Table 6-1. The growth update indicates a slightly lower number of residential units and more commercial/industrial area than what was projected in the last Master Plan Update. In Table 6-1, the shaded rows identify LFMZs that are not within the City of Carlsbad sewer system boundary or sphere of influence.

Table 6-1
CITY OF CARLSBAD GROWTH DATABASE SUMMARY

LFMZ No.	No. of Res. Units		Non-Residential Bldg Area (sqft)	Comments
	SFDU	MFDU		
1	430	0	0	Downtown area; Unit counts from 5/15/02 LFMZ 1 update
2	25	146	39,656	3 second dwelling units counted as MFU
3	13	0	193,251	
4	0	0	50,000	
5	0	0	4,137,974	Includes Faraday Business Park and airport
6	185	0	89,988	Future church assumed at 9,100 sqft (25% coverage)
7	345	436	32,670	Calavera unit counts from 7/15/02 update; Future elem.school
8	186	544	6,000	Kelly Ranch
9	41	0	428,100	
10	750	320	0	Villages of La Costa; Future elementary school
11	1,266	275	622,972	Villages of La Costa
12	55	0	20,000	Future church assumed at 20,000 sqft
13	0	18	1,482,142	24 room hotel expansion assumed at 1 hotel uni =.75 MFU
14	711	411	229,166	Unit counts from Robertson Ranch update; Future High School
15	807	158	303,798	Sycamore Creek; 8 second dwelling units counted as MFU
16	0	0	1,921,000	Carlsbad Oaks North BP; Building area from 8/01/02 update
17	523	100	2,511,000	Bressi Ranch; 40,000 sqft for private school & daycare/church
18	308	0	2,262,817	140 condos counted as SFU
19	218	78	69,520	61 condos counted as SFU; 78 timeshares counted as MFU
20	687	24	73,450	
21	185	210	0	
22	168	286	53,280	149 condos counted as SFU
23	0	264	507,000	includes assisted living project (non-res & MFUs)
24	32	0	0	
25	130	0	0	
Totals:	**7,065**	**3,270**	**15,033,784**	*shaded rows indicate areas outside of the sewer service area*

6.3 FUTURE FLOW GENERATION FACTORS

Flow generation factors are used, in conjunction with the City's Growth Database, to project ultimate wastewater flows and distribute flows in the ultimate system hydraulic analysis. Unit flow generation rates were developed and presented in Chapter 4 of this report based on 2001 flow data. These unit flow factors were used to distribute flow in the existing system model. For design and planning purposes, a more conservative approach to flow generation is used. The unit flow factors developed to project ultimate wastewater flows from data in the City's Growth Database are listed in Table 6-2, which also provides a comparison of flow generation factors used in previous planning documents.

Table 6-2
CARLSBAD WASTEWATER UNIT FLOW COMPARISONS

Land Use Category	Existing System (Based on 2001 meter data and/or water billing records)	1991 Master Plan	1997 Master Plan Update	2002 Master Plan for Future Flows
Single Family DU	195 gpd/DU	220 gpd/DU	209 gpd/DU	**220 gpd/DU**
Multi-Family DU		220 gpd/DU	209 gpd/DU	**160 gpd/DU**
Faraday Business Park	715 gpd/acre 561 gpd/10,000 sqft			
Restaurants	6,500 gpd/10,000 sqft			
Non-residential			1000 gpd/acre 918 gpd/10,000 sqft*	**1,150 gpd/10,000 sqft**
Commercial		1,230 gpd/10,000 sqft		
Industrial		750 gpd/10,000 sqft		

* Conversion from flow per acre to flow per building area based on an assumed building coverage of 25% of the parcel size.

The City's established planning value for wastewater flow is 220 gpd/EDU. Flow factors typically used for design in sewer systems throughout San Diego County range between approximately 208 gpd/EDU in the City of Encinitas, to approximately 265 gpd/EDU in the City of Chula Vista. The City of San Diego Water & Sewer Design Guide recommends the use of 90 gallons per capita day (gpcd). Based on an average of approximately 2.5 to 2.6 persons per household, a flow factor between 225 and 235 gpd/EDU would be recommended using the City of San Diego's design criteria. Based on these comparisons and the calculated unit flow rate for current conditions, the previously established flow generation rate of 220 gpd/EDU is considered to be appropriate for flow projections for this Master Plan Update.

The Carlsbad Growth Database projects the number of future multi-family units to be constructed. According to City Staff, multi-family units are defined as apartment units or low-income housing units. A lower flow factor for multi-family units was developed based on a research of water billing records and a comparison of unit flows used by other agencies. The multi-family unit flow factor was also applied to hotel units, timeshares, second housing units constructed on existing residential parcels, and housing densities in excess of 12 units per acre on development plans.

The non-residential land use flow factor is applied to building area projections in the Growth Database. This broad category includes commercial, industrial, medical and office buildings. The composite unit factor is based on an assumed mix of the land use types and is appropriate (and probably somewhat conservative) for flow projections of the overall sewer system. Projections made using this factor may not be representative of smaller areas with a single land use type. Flow projections for future schools were based on EDU conversions documented in the Carlsbad Municipal Code (Table 13.10.020c).

6.4 PROJECTED ULTIMATE FLOWS

Flow projections for future developments were made by applying the unit flow factors, documented in Section 6.3 of this report, to the future build-out data in the Growth Database. Parcels with identified future growth were then apportioned to sub-drainage basins using GIS techniques. Future flows were added to the existing flows in each sub-basin to obtain ultimate flows. Upon review of the flow data it was determined that a few of the newer residential areas in the collection system had existing sewer flows (based on water meter records) but were also included in the Growth Database. The future flow for these parcels was subsequently deleted from the Growth Database used for this project.

The ADWF flow for the ultimate sewer system is projected to be approximately 9.9 MGD. This value represents an increase of approximately 3.0 MGD, or 45 percent, over existing wastewater flows. Figure 6-2 presents historical flows and the projected ultimate flow, and makes a comparison with previous flow projections. Table 6-3 lists the existing and projected future flows by sub-drainage basin.

Figure 6-2
HISTORICAL AND PROJECTED ULTIMATE FLOWS

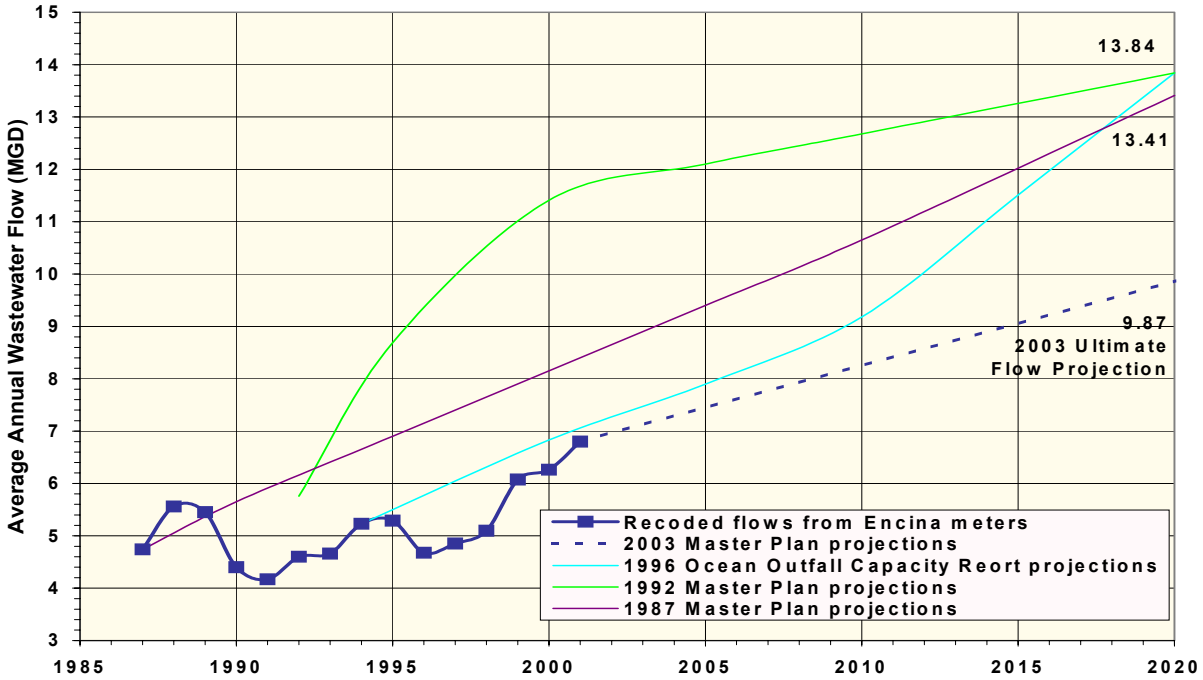


Table 6-3
PROJECTED ULTIMATE WASTEWATER FLOWS BY SUB-BASIN

Sub-basin	Interceptor System	Existing Units/Flow		Projected Future Units and Flow				Ultimate System	
		SF Units	Flow (gpm)	SF Units	MF units	Bldg sqft	Flow (gpm)	SF Units	Flow (gpm)
1A	V/C	153	113.0	16	0	0	2.4	169	115.4
1B	V/C	208	47.4	0	0	0	0.0	208	47.4
1C	V/C	118	16.0	0	0	0	0.0	118	16.0
1D	V/C	428	139.3	37	0	0	5.7	465	144.9
1E	V/C	1,302	350.4	42	0	0	6.4	1,344	356.8
1F	V/C	560	180.2	6	0	0	0.9	566	181.2
1G	V/C	266	265.7	14	0	0	2.1	280	267.9
1H	V/C	606	201.4	69	0	0	10.5	675	211.9
1I	NAH	945	183.8	172	0	0	26.3	1,117	210.1
1J	NAH	949	148.0	74	70	0	19.1	1,023	167.1
2A	V/C	583	146.9	0	143	39,656	19.1	583	166.0
2B	V/C	223	30.2	0	0	0	0.0	223	30.2
2C	NAH	1,412	191.8	25	3	0	4.2	1,437	195.9
3A	V/C	244	178.9	13	0	0	2.0	257	180.9
3B	V/C	0	108.0	0	0	165,351	13.2	0	121.2
3C	Buena	0	41.2	0	0	27,900	2.2	0	43.5
4A	Buena	1,252	227.5	0	0	50,000	4.0	1,252	231.5
4B	NB	857	128.5	0	0	0	0.0	857	128.5
5A	SAH	0	4.9	0	0	407,703	32.6	0	37.5
5B	SAH	2	152.4	0	0	718,609	57.5	2	209.9
5C	Buena	0	23.4	0	0	399,641	32.0	0	55.4
5D	SAH	0	11.0	0	0	59,864	4.8	0	15.8
5E	Buena	0	39.2	0	0	238,273	19.1	0	58.2
5F	Buena	0	14.1	0	0	0	0.0	0	14.1
5G	Vallecitos	0	39.3	0	0	770,099	61.6	0	100.9
5H	Vallecitos	0	0.0	0	0	365,905	29.3	0	29.3
5I	Buena	0	105.2	0	0	429,580	34.4	0	139.5
5J	Buena	0	12.8	0	0	96,754	7.7	0	20.5
5K	Vallecitos	5	43.4	0	0	651,536	52.1	5	95.5
6A	NB	498	112.5	0	0	14,715	1.2	498	113.7
6B[(1)]	Vallecitos	0	0.0	111	0	0	17.0	111	17.0
7A	V/C	527	77.2	103	0	21,780	17.5	630	94.7
7B	NAH	448	75.8	0	117	10,890	13.9	448	89.7
7C	SAH	383	51.9	242	319	23,913	74.3	625	126.2
8	SAH	133	18.0	161	474	6,000	77.7	294	95.8
9	NB	513	177.2	41	0	428,100	40.5	554	217.7
10A	Vallecitos	0	0.0	207	0	23,913	33.5	207	33.5
10B	Vallecitos	0	0.0	164	0	0	25.1	164	25.1
10C	Vallecitos	0	0.0	118	0	0	18.0	118	18.0
13A	SAH	0	4.4	0	0	1,330,600	106.4	0	110.8
13B	Vallecitos	0	113.0	0	0	151,542	12.1	0	125.1
14A	SAH	0	0.0	530	78	388,310	120.7	530	120.7
14B	NAH	1	3.4	181	333	23,872	66.6	182	70.0

Continued next page

Table 6-3 ***(Continued)***

Sub-basin	Interceptor System	Existing Units/Flow		Projected Future Units and Flow				Ultimate System	
		SF Units	Flow (gpm)	SF Units	MF units	Bldg sqft	Flow (gpm)	SF Units	Flow (gpm)
15A	SAH	0	0.0	46	100	0	18.1	46	18.1
15B	SAH	4	55.5	589	80	303,798	123.2	593	178.6
16	SAH	0	0.0	0	0	1,921,000	153.7	0	153.7
17A	Vallecitos	0	0.0	383	100	2,471,000	267.3	383	267.3
17B	Vallecitos	0	0.0	140	0	40,000	24.6	140	24.6
18A	SAH	0	0.0	0	0	2,221,000	177.7	0	177.7
18B	Vallecitos	951	157.5	148	0	41,817	26.0	1,099	183.4
19A	NB	414	61.0	11	0	0	1.7	425	62.7
19B	NB	176	123.1	61	78	69,520	23.5	237	146.6
19C	NB	400	60.3	121	0	0	18.5	521	78.8
19D	NB	447	61.5	25	0	0	3.8	472	65.3
20A	Vallecitos	556	79.3	215	0	0	32.8	771	112.2
20B	Buena	291	40.4	50	0	13,450	8.7	341	49.1
20C	NB	221	29.9	239	24	0	39.2	460	69.1
20D	NB	92	12.5	78	0	60,000	16.7	170	29.2
20E	NB	2	0.3	104	0	0	15.9	106	16.2
21A	NB	138	20.6	62	53	0	15.4	200	36.0
21B	NB	82	21.0	123	157	0	36.2	205	57.2
21C	Vallecitos	0	36.9	0	0	0	0.0	0	36.9
22A	V/C	0	19.0	0	0	0	0.0	0	19.0
22B	NB	137	112.8	168	0	40,780	28.9	305	141.8
24A	SAH	233	31.5	0	0	0	0.0	233	31.5
24B	SAH	1	20.6	32	0	0	4.9	33	25.5
25	V/C	0	0.0	130	0	0	19.9	130	19.9
Totals:		**16,761**	**4,721 gpm 6.80 MGD**	**5,051**	**2,129**	**14,026,871**	**2,130 gpm 3.07 MGD**	**21,812**	**6,851 gpm 9.87 MGD**

(1) Flows from this sub-basin currently discharge to Leucadia County Water District
(2) Flow projections are based on the following unit flows: 220 gpd per single family unit, 160 gpd per multi-family unit, and 1,150 gpd/10,000 sqft of building area for non-residential flows.

6.5 OTHER AGENCY FLOW PROJECTIONS

Ultimate flow projections from other agencies that discharge to the Carlsbad sewer system were obtained from recent planning documents. Table 6-4 lists the total projected ultimate flow to the Encina WPCF from its member agencies, and allocates the flow to the Carlsbad interceptor systems. Flows from other agencies are allocated to the same interceptor system to which existing flows are currently discharged.

Table 6-4
EXISTING AND PROJECTED ULTIMATE ADWF TO THE ENCINA WPCF

Interceptor System	Existing Flows (Aug 2001)				Projected Ultimate Flows			
	Carlsbad Flows	Other Agency Flows		Total Flow	Carlsbad Flows	Other Agency Flows[1]		Total Flow
		Agency	Flow			Agency	Flow	
Vista/ Carlsbad	2.55 MGD	City of Vista & Oceanside	5.84 MGD	8.39 MGD	2.83 MGD	City of Vista & Oceanside	9.72 MGD	12.55 MGD
North Agua Hedionda	1.30 MGD	---	---	1.30 MGD	1.07 MGD	---	---	1.07 MGD
South Agua Hedionda	---	---	---	---	1.87 MGD	---	---	1.87 MGD
Buena	0.73 MGD	Buena Vista (raceway)	1.84 MGD 0.20 MGD	2.77 MGD	0.88 MGD	Buena Vista (raceway)	3.31 MGD 0.60 MGD	4.79 MGD
Vallecitos	0.90 MGD	Vallecitos	4.28 MGD	5.18 MGD	1.54 MGD	Vallecitos	11.04 MGD	12.58 MGD
North Batiquitos	1.33 MGD	Leucadia/ Encinitas	5.14 MGD	6.47 MGD	1.67 MGD	Leucadia/ Encinitas	8.01 MGD	9.68 MGD
Totals:	**6.81 MGD**		**17.3 MGD**	**24.1 MGD**	**9.87 MGD**		**32.7 MGD**	**42.5 MGD**

(1) Other agency ultimate flow projections obtained from their most recent master planing documents

From Table 6-4 it is apparent that flows from Carlsbad will increase within all existing interceptors except the NAH Interceptor. The majority of the flow increase to the V/C Interceptor is projected to be generated by the City of Vista. The downstream reaches of this intercepetor convey Carlsbad flows from the NAH and SAH Intercepetors, which are not included in the flow to the V/C Interceptor in Table 6-4. In the ultimate system, it is projected that reaches VC14 and VA15 will convey an additional 3.9 MGD of flow from the City of Vista and an additional 1.9 MGD from the City of Carlsbad.

The ultimate flows apportioned to the Buena and Vallecitos Interceptors will exceed the capacity of the existing pipelines during peak flow conditions. The City of Vista is planning to divert a portion of their flow from the Buena Interceptor to the Vallecitos Interceptor in the future, and the VWD is planning a replacement of the Vallecitos Interceptor with increased capacity. Since the City of Carlsbad leases flow capacity in the Buena Interceptor and has a minority capacity ownership in the Vallecitos Interceptor, an ultimate hydraulic analysis accounting for upstream agency flows will not be performed on these Interceptors. Projected peak flows from Carlsbad are instead summarized and compared to existing capacity agreements.

6.6 ULTIMATE INTERCEPTOR SYSTEM HYDRAULIC MODEL

Analysis of the ultimate interceptor system was accomplished by adding the SAH Interceptor to the existing system model. Physical data for the SAH Interceptor was obtained from the existing system GIS for portions that have already been constructed, and available design drawings. The SAH Lift Station was evaluated assuming variable frequency drive pumping units. Interceptor discharge locations for sub-basins were re-assigned, as appropriate, to reflect planned changes to the ultimate system. The projected

ADWF based on build-out of the sub-basins (Table 6-3) was then input to the model for internal flows. External flows from other agencies were evaluated for the V/C and NB Interceptors (Table 6-4).

Hydraulic analyses were performed to determine the ability of the interceptors to convey projected peak flows. To calculate the PDWF, the dry weather peaking curves developed for the City of Vista and Leucadia/Encinitas based on existing flows (Figure 5-1) were "scaled up" to reflect the higher base loads in the ultimate system. The unit peaking curves for residential and non-residential flows within Carlsbad (Figure 5-2) were applied to the projected ultimate average flows in each sub-basin.

PWWF analyses were performed on the V/C and NB Interceptor systems. The internal and external defect flows, based on existing wet weather meter data, were increased by 20 percent in the ultimate system to account for aging of the pipelines and increased inflow from a larger collection system. Internal defect flows for the NAH, SAH, and Vallecitos Interceptors, and the NB Interceptor upstream of the NB Lift Station could not be determined from existing meter data. The NAH, SAH, and upstream NB Interceptor systems were analyzed with peak dry weather flows, and evaluated based on gravity sewers flowing 75 percent full.

City of Carlsbad flows were analyzed in the Buena and Vallecitos Interceptors and the peak flows compared to existing capacity rights. For the Buena Interceptor, the internal I&I calculated for the existing system was increased by 20 percent. This same defect flow was assumed for the Vallecitos Interceptor in the ultimate analysis, which is considered a valid assumption as this pipeline ages since both interceptors share a common alignment over most of the their length.

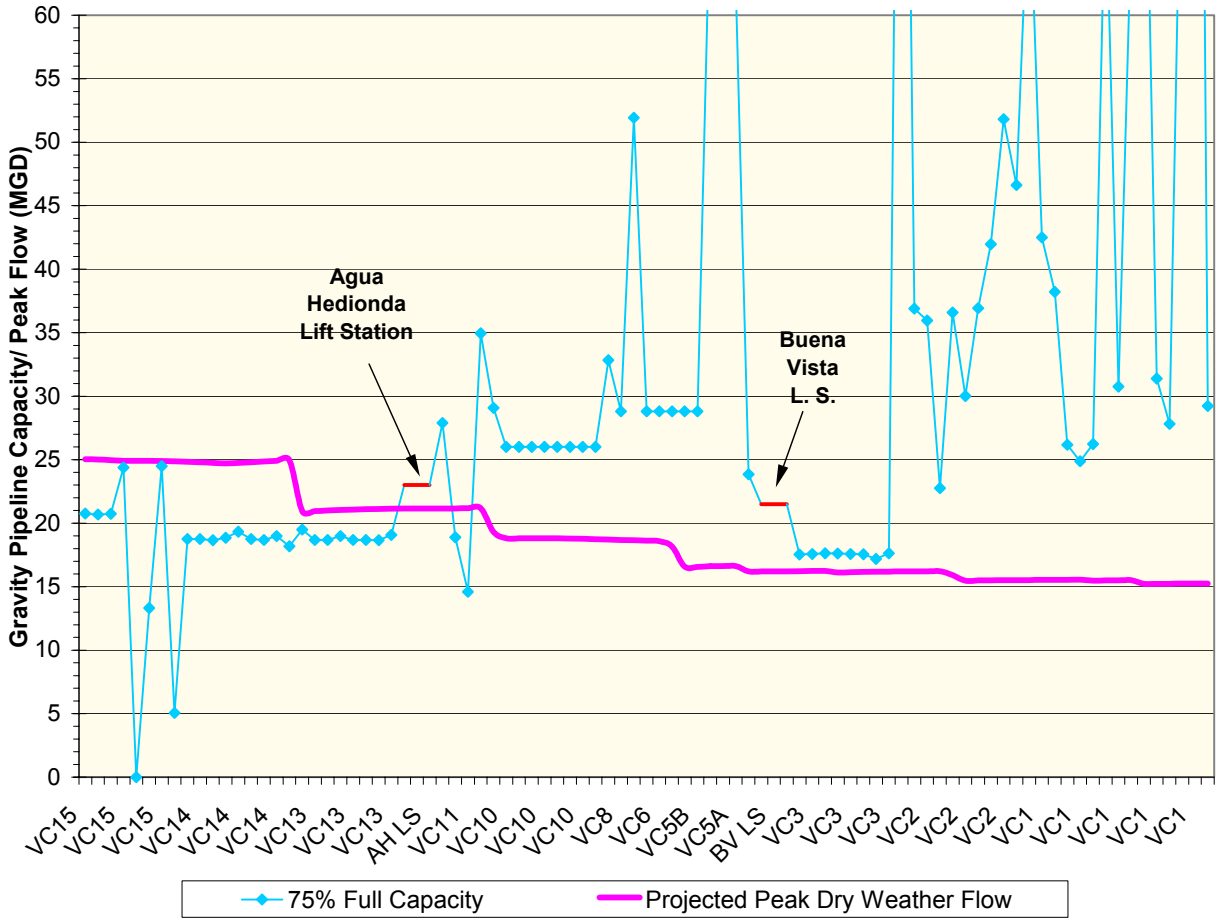
6.7 CAPACITY ANALYSIS RESULTS

Flow analysis results from the SewerCAD ultimate system model are presented graphically for each interceptor system and compared to the gravity pipeline capacities. The graphs illustrate the composite peak flow in each pipeline segment over the course of the 24-hour flow simulation. Flows and capacities are schematically illustrated according to the reach designations shown in Figure 3-1. Where lift stations are included in the interceptor, the lift station name and firm pumping capacity are indicated on the graph.

6.7.1 Vista/Carlsbad Interceptor

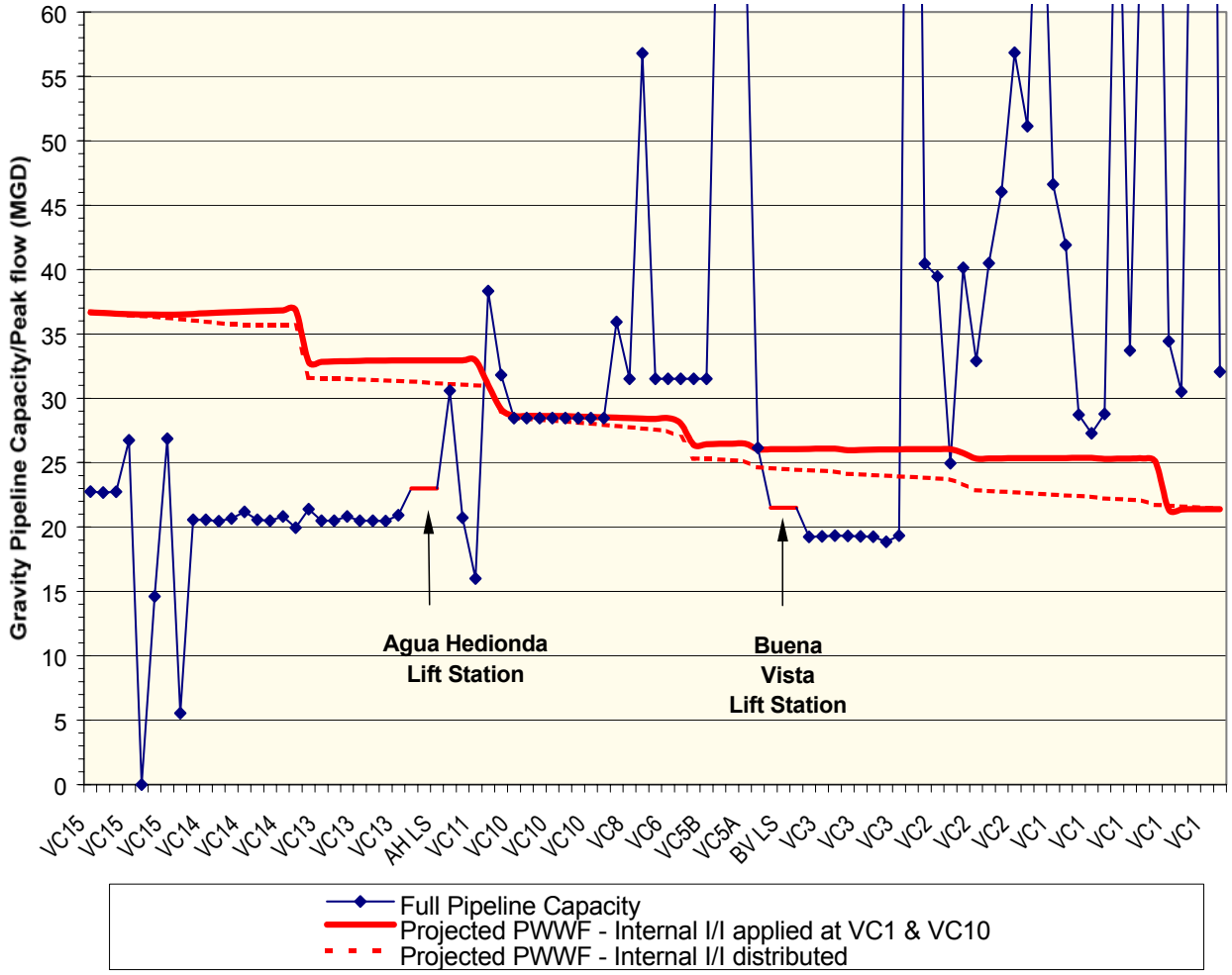
Figure 6-3 illustrates the projected ultimate PDWF in the V/C Interceptor, and provides a comparison with the pipeline design capacity (d/D = 75%). At the upstream end of Reach VC1, the City of Vista and Oceanside contribute a collective projected peak flow of approximately 15.2 MGD. Between the Buena Vista and Agua Hedionda Lift stations, the V/C Interceptor collects flow from the Home Plant Lift Station and the NAH Interceptor. Flow from the SAH Interceptor is added downstream of the Agua Hedionda Lift Station at Reach VC14. From this graph it is apparent the reaches downstream of VC10 will need to be upsized based on future peak dry weather flows.

Figure 6-3
V/C INTERCEPTOR WITH PROJECTED PEAK DRY WEATHER FLOWS



While the flow information presented on Figure 6-3 is informative, historical I&I rates to the V/C Interceptor are very high, and replacement sewers must be designed based on the projected PWWF. Figure 6-4 illustrates results from the PWWF analysis, and makes a comparison with existing pipeline capacities. For this analysis, a peak I&I rate of 6.1 MGD was added to City of Vista projected peak dry weather flows. The I&I attributed to Carlsbad, 5.6 MGD, was distributed two different ways. One flow scenario distributes the I&I along the length of the V/C Interceptor. The other, more conservative scenario, assigns most of I&I to the upstream Reach V1, with the remainder at the confluence with the NAH Interceptor. As stated previously, it is not known how much I&I is currently contributed by the NAH Interceptor. Although the internal I&I rate in the ultimate system model was increased by 20 percent over the existing I&I rate, it is noted that I&I was not included for the SAH Interceptor. Flows entering the V/C Interceptor at the upstream end of Reach VC14 are therefore based on the projected peak dry weather flow from the SAH Interceptor.

Figure 6-4
V/C INTERCEPTOR PEAK WET WEATHER FLOW



From Figure 6-4, it is apparent that the reaches downstream of VC10, Reach VC3, and the Buena Vista and Agua Hedionda Lift Stations are not adequately sized to convey the projected PWWF. In addition, analysis results indicate that Reach VC10, which is currently under construction as a 48-inch diameter pipeline, may flow full during severe storm events.

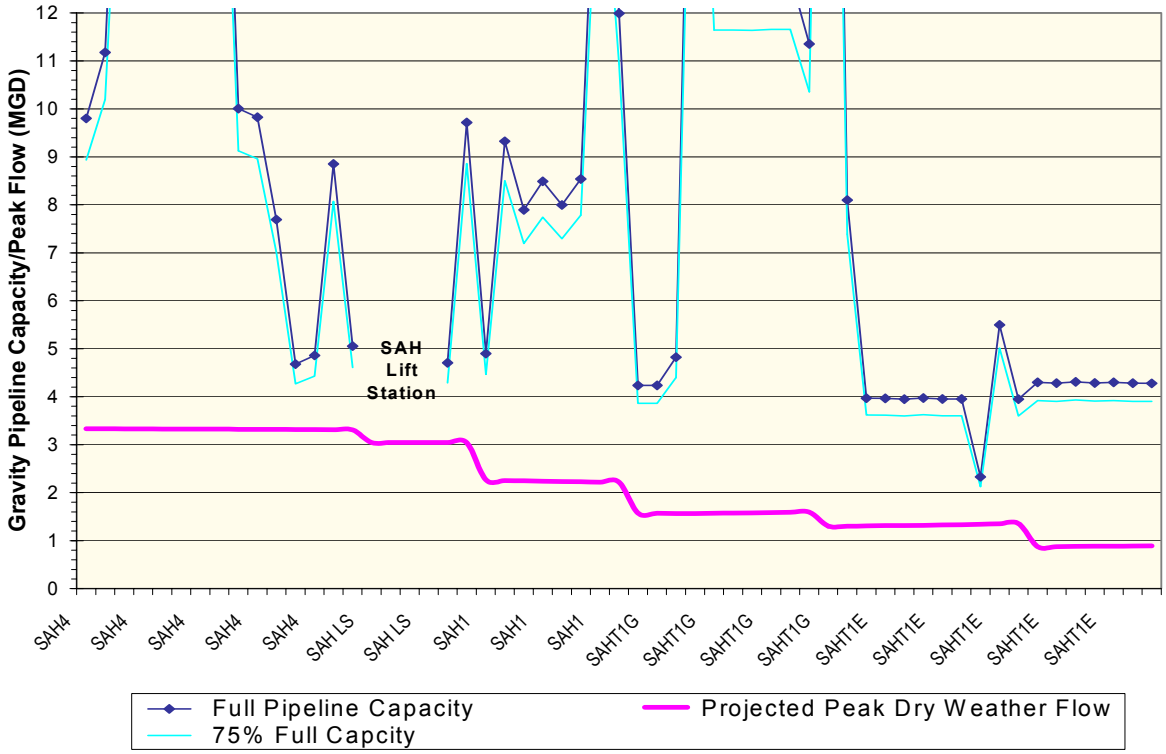
6.1.1 North Agua Hedionda Interceptor

The projected ultimate ADWF for the NAH Interceptor is approximately 1.07 mgd, which is less that the existing ADWF of 1.3 MGD. The capacity of the NAH Interceptor was determined to be sufficient to convey existing flows, with the exception of several short reaches. Therefore, additional analysis of this interceptor system was not performed with ultimate system flows. A discussion of the capacity of the NAH Interceptor is provided in Section 5.3.3 of this report.

6.1.2 South Agua Hedionda interceptor

The projected ultimate PDWF and design capacity of the SAH Interceptor are illustrated on Figure 6.5. The upstream sewer along El Camino Real and Sunny Creek Road (SAHT1E and SAHT1G) is also depicted in Figure 6-5, since this portion of the SAH Interceptor system will convey the most flow. As shown on the graph, there is projected to be ample capacity in the gravity interceptor system. The PDWF through the SAH Lift Station is projected to be approximately 3.0 MGD. The lift station capacity will need to be greater to convey peak wet weather flows.

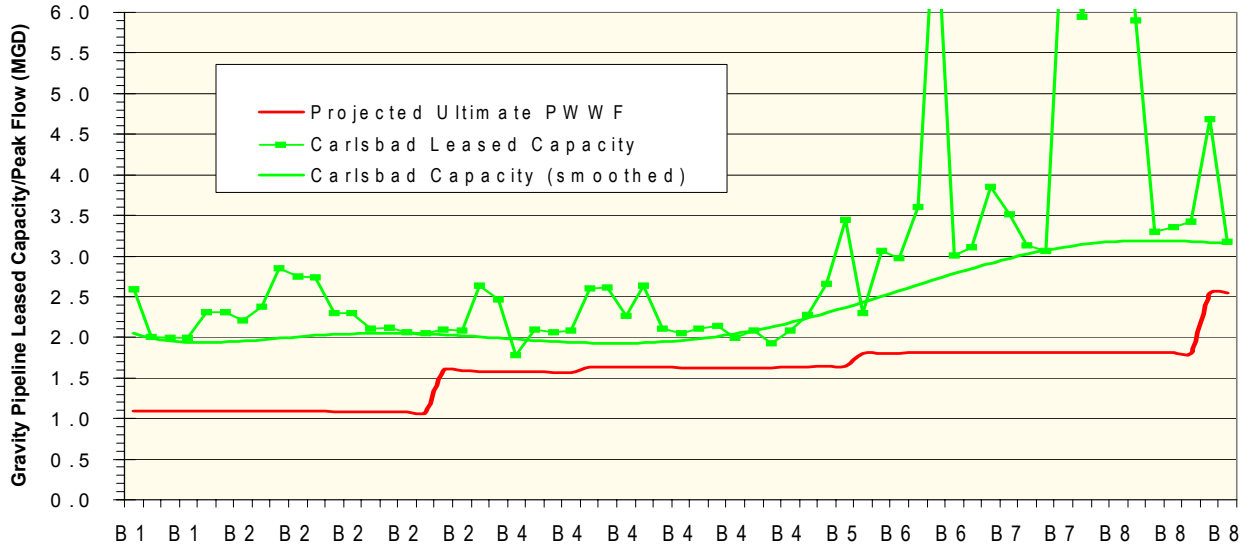
Figure 6-5
SOUTH AGUA HEDIONDA PEAK DRY WEATHER FLOW



6.1.3 Buena Interceptor

The sub-drainage basins served by the Buena Interceptor in the ultimate system are planned to be the same as those served in the existing system. Flows to this interceptor are projected to increase by approximately 20 percent. As discussed in Section 5.2.2 of this report, the existing flow in Table 6-4 for the Buena Interceptor is lower than current metered flows. Flows used in the ultimate system analysis for the Buena Interceptor are based on future flows added to the existing meter flows, and result in a total ADWF of approximately 1.2 MGD. Figure 6-6 illustrates the projected ultimate PWWF generated by Carlsbad in the Buena Interceptor, and makes a comparison with existing capacity rights. As shown on the chart, the current leased capacity is projected to be sufficient to convey ultimate flows.

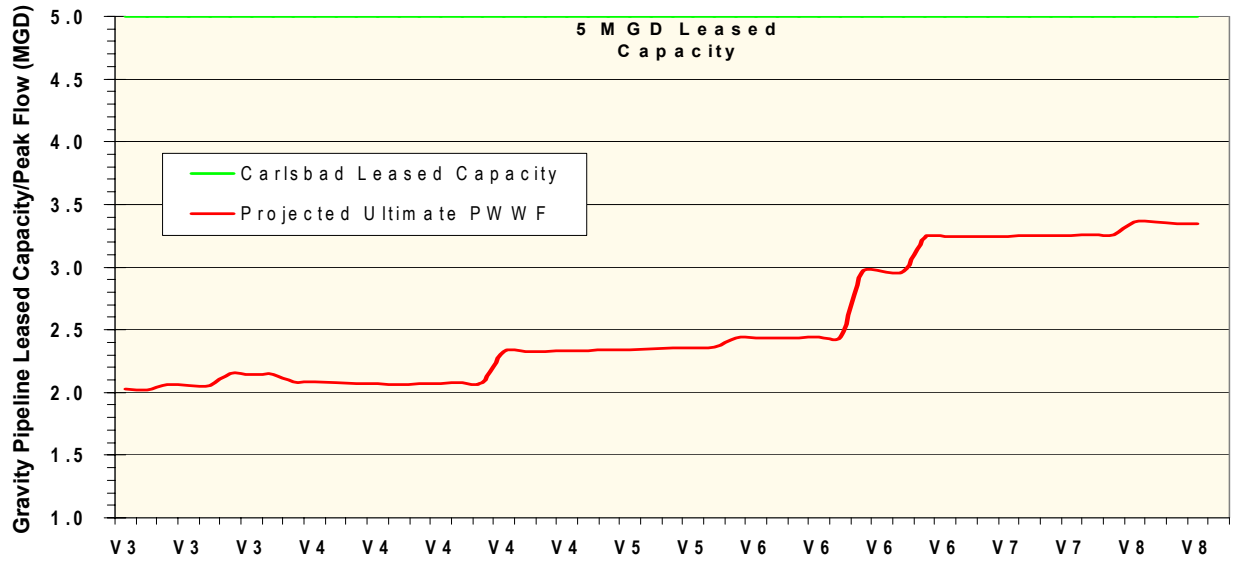
Figure 6-6
PROJECTED CARLSBAD PWWF IN THE BUENA INTERCEPTOR



6.1.4 Vallecitos Interceptor

Figure 6-7 illustrates the projected ultimate PWWF generated by Carlsbad in the Vallecitos Interceptor, and makes a comparison with the existing capacity rights of 5.0 MGD. Although flows to this interceptor are projected to increase by approximately 70 percent, the current leased capacity is projected to be sufficient to convey ultimate flows, as shown on the graph.

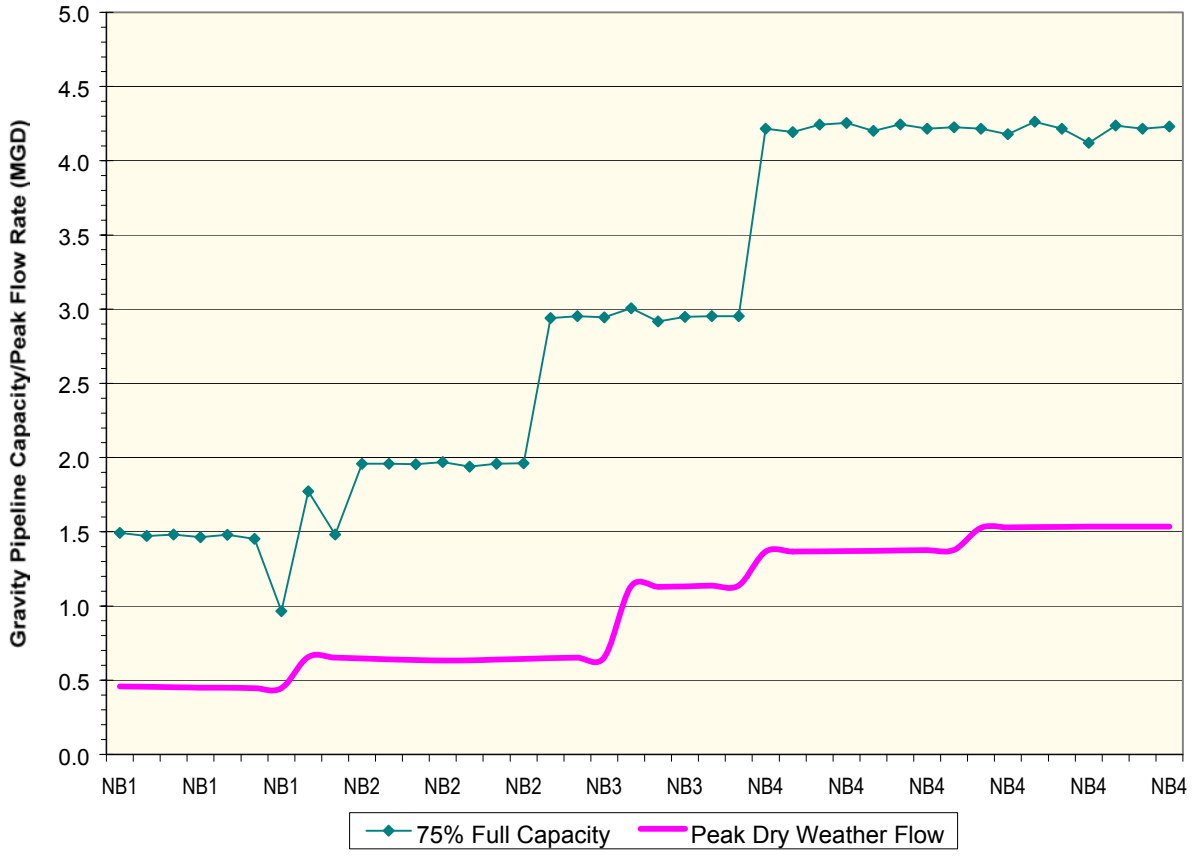
Figure 6-7
PROJECTED CARLSBAD PWWF IN THE VALLECITOS INTERCEPTOR



6.1.5 North Batiquitos Interceptor

The upstream portion of the North Batiquitos Interceptor conveys only City of Carlsbad flows. This portion of the Interceptor was analyzed with the projected PDWF and compared to the design capacity of the gravity pipelines, as illustrated in Figure 6-8. As indicated on the graph, there is ample capacity in the upstream gravity pipelines to convey the projected ultimate flows. Flow to the North Batiquitos Lift Station consists of flow from the main interceptor and the northern trunk line, Reach NBT3B. The PDWF to the lift station is projected to be 2.1 MGD (1,500 gpm).

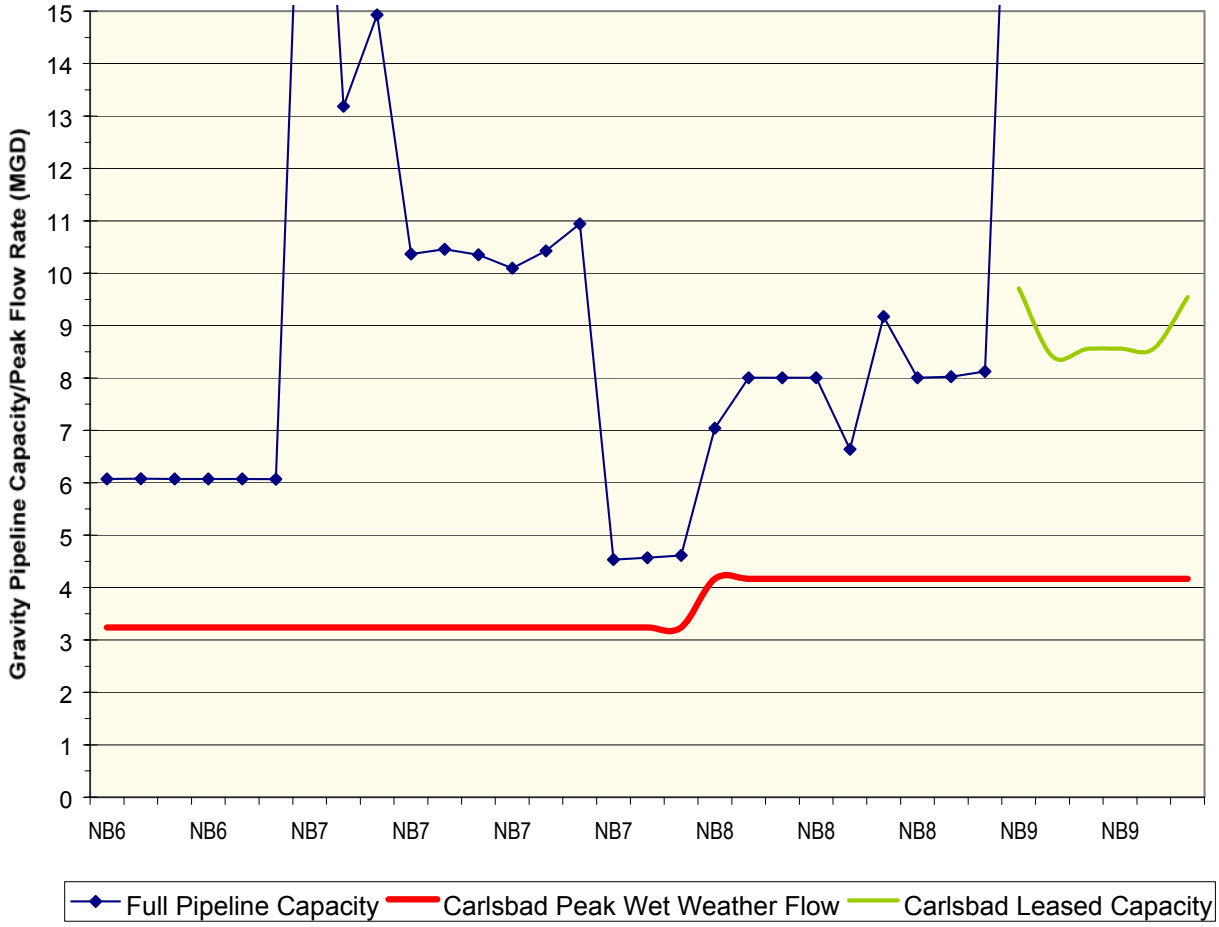
Figure 6-8
CARLSBAD PDWF IN THE UPSTREAM NORTH BATIQUITOS INTERCEPTOR



The North Batiquitos Lift Station consists of two duty pumps with fixed speed drives. During peak flow periods one pumping unit is projected to operate continuously, with the second pump cycling on and off. The North Batiquitos Interceptor downstream of the lift station was analyzed with both pumps in operation. City of Carlsbad flows in this portion of the Interceptor are shown on Figure 6-9, together with the full gravity pipeline capacities and leased capacity in the Occidental Sewer. Based on this analysis,

the existing leased capacity is projected to be approximately 4.0 MGD in excess of what is required to convey projected peak ultimate flows.

Figure 6-9
CARLSBAD PWWF IN THE DOWNSTREAM NORTH BATIQUITOS INTERCEPTOR



6.7.7 Lift Stations

The projected ultimate PWWF through each of the lift stations included in the sewer interceptor system is shown in Table 6-5. Also provided in this table is a comparison with existing lift station capacities and the velocity in the lift station force mains based on the projected peak flow. For interceptor systems without existing wet weather data (gravity pipelines analyzed based on the PDWF), the PWWF at the lift station is estimated based on the general wet weather peaking factors used in the previous Master Plan.

Table 6-5
PROJECTED PEAK FLOWS AT LIFT STATIONS

Lift Station Name	Interceptor System	Station Capacity [1]		Projected Ultimate Flow		Force Main Diam.	Max. Ult. Velocity in FM (fps)
		(gpm)	(MGD)	PDWF (MGD)	PWWF (MGD)		
Buena Vista	V/C	14,000	20.16	16.2	26.0	16"&24"	9.5
						24"	12.8
						2-16"	14.4
Agua Hedionda	V/C	16,000	23.04	21.2	31-33 [2]	2-18"	14.4
Foxes	NAH	2,600	3.74	1.9	2.6 [3]	12"	5.1
South Agua Hedionda	SAH	---	---	3.0	4.2 [3]	14"	6.1
North Batiquitos	NB	2,250	3.24	2.1	2.9 [3]	14"	4.7

(1) Existing duty capacity with one pump out-of-service
(2) Projected PWWF flow varies depending on the distribution assumptions of I&I in the Carlsbad system.
(3) Existlng wet weather data not available. PWWF assumed at 1.4 x the PDWF

For the remaining lift stations in the sewer collection system, only the service area of the Simsbury lift Station is expected to increase significantly. Although the Simsbury Lift Station is ultimately planned to be abandoned once a gravity line is constructed to the V/C interceptor through LFMZ 25, it may first serve future development in the west portion of Sub-basin 7A. Based on the City's Growth Database, an additional 103 EDUs are planned, with a corresponding projected flow increase of approximately 16 gpm.

CHAPTER 7
RECOMMENDATIONS

Wastewater flow generated within the City of Carlsbad is projected to increase by approximately 45 percent over existing flows, to a projected ultimate flow of approximately 9.9 MGD by the year 2020 (shown previously on Figure 6-2). This chapter summarizes recommended improvements to the existing sewer interceptor system required to adequately convey, pump, treat and dispose of the projected ultimate wastewater volumes. Joint agency agreements, capacity agreements with the Encina WPCF, potential future flows from other agencies, and inflow and infiltration are also discussed relative to buildout conditions. A recommended Capital Improvement Program is provided at the end of the chapter with an opinion of probable construction costs for each recommended project.

7.1 VISTA/CARLSBAD INTERCEPTOR IMPROVEMENTS

The V/C Interceptor Sewer collects wastewater from the City of Vista and the northern and downtown areas of the City of Carlsbad. The V/C Interceptor also collects flow from the NAH Interceptor, and will collect future flows from the SAH Interceptor. Approximately 2.5 miles of gravity pipeline in the V/C Interceptor are currently being replaced to increase capacity between the Buena Vista Lift Station force main and the Agua Hedionda Lagoon crossing (Reaches VC5-VC11A), For the purposes of this Master Plan Update, this current replacement project is considered a part of the existing V/C Interceptor.

Additional replacement projects are recommended to increase the capacity of the interceptor based on projected peak flows. The projected PWWF in the V/C Interceptor is shown on Figure 7-1, together with the capacity of the existing pipeline reaches and the recommended pipeline capacities. The design capacity of the new pipelines is calculated based on the average slope of the existing reach and a Manning's coefficient ("η") of 0.012, assuming that the future pipe will be PVC-lined. The recommended projects are summarized in Table 7-1, together with an opinion of the probable construction cost, and discussed in the following sections.

It is noted that the ultimate PWWF in the V/C Interceptor projected in this Master Plan Update is slightly higher than the peak flows projected in the 1992 Master Plan Update. While the projected ultimate ADWF to the V/C Interceptor from the City of Carlsbad is approximately 40 percent less than the flow projected in 1997, peak flows in the V/C Interceptor are higher as a result of the I&I investigation performed in this Master Plan Update. Peak flows from the ultimate PWWF analysis in the downstream reach of the V/C Interceptor (City of Vista and Carlsbad flows) are projected to be approximately 2.4 times the ADWF. The analysis performed in the 1992 Master Plan used a standard peaking equation, which resulted in a peak flow that was 2.0 times the ADWF in the downstream reaches of the V/C Interceptor.

Figure 7-1
V/C INTERCEPTOR CAPACITY WITH RECOMMENDED IMPROVEMENTS

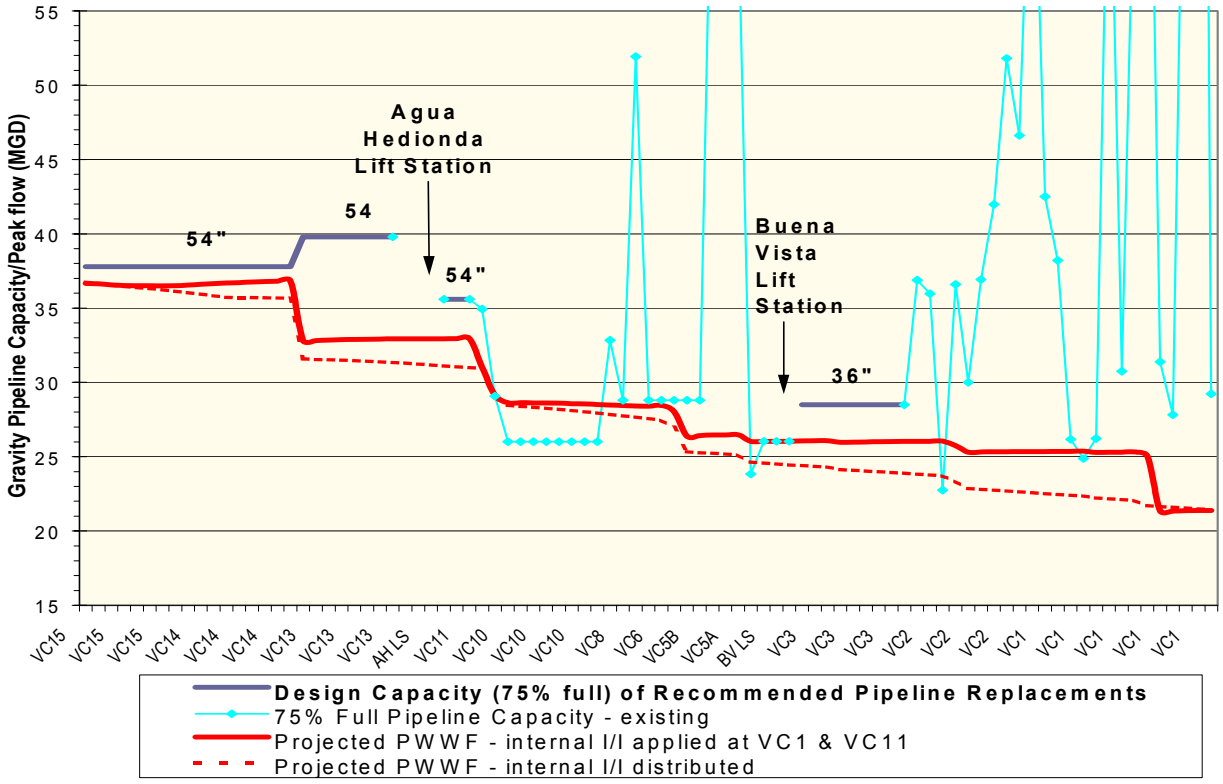


Table 7-1
SUMMARY OF V/C INTERCEPTOR RECOMMEND IMPROVEMENTS

Reach ID	Projected Ult. PWWF (MGD)	Existing Pipe				Replacement Pipe			Unit Cost[2] ($/lin. ft.)	Probable Construction Cost[3]
		Length (feet)	Avg. Slope (ft/ft)	Diam. (in.)	Full Capacity (MGD)	Diam[1] (in.)	Design Capacity (MGD)	Full Capacity (MGD)		
VC3	26.0	3,350	0.0020	36	20.7	42	28.5	31.6	$568.20	$ 2,570,000
BVLS[5]	26.0	--	--	--	--	--	--	--	--	$ 735,132
VC4-FM	26.0	3,840	NA	16"&24"	--	24	26.0	--	$240.00	$ 1,244,000
VC11B[4]	33.0	915	0.0008	42	18.4	54	35.6	39.0	$730.50	$ 2,900,000
AHLS[5]	33.0	--	--	--	--	--	--	--	--	$ 6,250,000
VC12-FM	33.0	200	NA	2-18"	--	36	33.0	--	$360.00	
VC13	33.0	3,510	0.0010	42	20.5	54	39.8	43.7	$730.50	$10,200,000
VC14	36.6	5,059	0.0009	42	19.6	54	37.8	41.4	$730.50	
VC15	36.6	1,772	0.0009	42	19.6	54	37.8	41.4	$730.50	

(1) Required diameter with the existing slope to convey the design capacity with the pipeline flowing 75% full

(2) Unit construction costs for gravity pipelines based on recent cost data from the 2001-2002 V/C Sewer Replacement Project. Force main unit costs are based on $10/diameter inch.

(3) Opinion of probable construction costs are order of magnitude planning costs. Costs exclude engineering, administrative, environmental and legal costs and include a 35% construction contingency.

(4) Replacement of this reach will include a new bridge crossing over the Agua Hedionda Logon. The cost includes an estimated cost for the bridge of $1,744,000 (developed by W. Koo & Assoc. in the April 2001 Design Report)

(5) Lift station costs include both capacity increase and rehabilitation costs, as defined in the City's current CIP. AH Lift Station upgrade based on Krieger & Stewart 2000 Preliminary Design Report, which includes replacement of the FM.

7.1.1 Upper V/C Interceptor Recommended Improvements

Figure 7-2 illustrates the recommended capacity improvements to the upper V/C Interceptor. Recommended pipeline diameters are shown for the replacement pipelines. In addition to the gravity pipeline replacement recommended for Reach VC3, capacity improvements are recommended for the Buena Vista Lift Station and force main. Pumping units were last replaced at the Buena Vista Lift Station in 1994. The reported firm capacity of the lift station is 14,000 gpm, and the projected ultimate PWWF at the station is approximately 18,000 gpm. The capacity of the Buena Vista Lift Station has never been confirmed due to existing downstream capacity limitations. Because of the long length of the force main (approximately 4,000 feet) and high pipeline velocities with projected ultimate flows, it may be possible to obtain the required increase in station capacity with the existing pumps and a larger forcemain.

The existing Buena Vista Lift Station force main (Reach VC4) consists of parallel pipelines (24- and 16-inch diameter) for most of its length. It is recommended that a new 24-inch diameter force main replace the 16-inch force main and parallel the existing 24-inch force main for its entire length. In addition to increasing the station capacity, the new parallel force main will reduce peak velocities and increase reliability.

7.1.2 Lower V/C Interceptor Recommended Improvements

Figure 7-3 illustrates the recommended capacity improvements to the lower V/C Interceptor. It is recommended that Reach VC11B and Reaches VC13 through VC15 be replaced with a 54-inch diameter pipeline. This pipe size assumes that the existing flat sections in Reach VC15 can be eliminated in the new design, and the pipeline slope for Reaches VC14 and VC15 will be a minimum of 0.09 percent. If the pipeline will have a slope of less than 0.09 percent, a 60-inch diameter pipeline will be required for Reaches VC14 and VC15 to satisfy City design criteria.

It is recommended that the capacity of the Agua Hedionda Lift Station be increased to a minimum of 33 MGD (23,000 gpm), which is the projected PWWF through the station. A new 36-inch diameter force main is also recommended to replace the existing parallel 18-inch diameter force mains (Reach VC12). There are several deficiencies with the existing Agua Hedionda Lift station, including an undersized wet well, lack of full operational redundancy, insufficient space around the pumping units, and problems related to the age and general condition of the station. *A Preliminary Design Report for Agua Hedionda Lift Station Upgrade*, dated March 7, 2000 was prepared for the City. Recommendations from the report include replacement of the existing lift station with the exception of the emergency generator building. The recommended project includes five new pumping units for a firm pumping capacity of 30 MGD, and a new headworks, wet well, control building, 2.5 MG emergency storage basin, and 36-inch diameter force main. As the result of this Master Plan Update analysis, the design flow through this station should be increased from 30 MGD to at least 33 MGD.

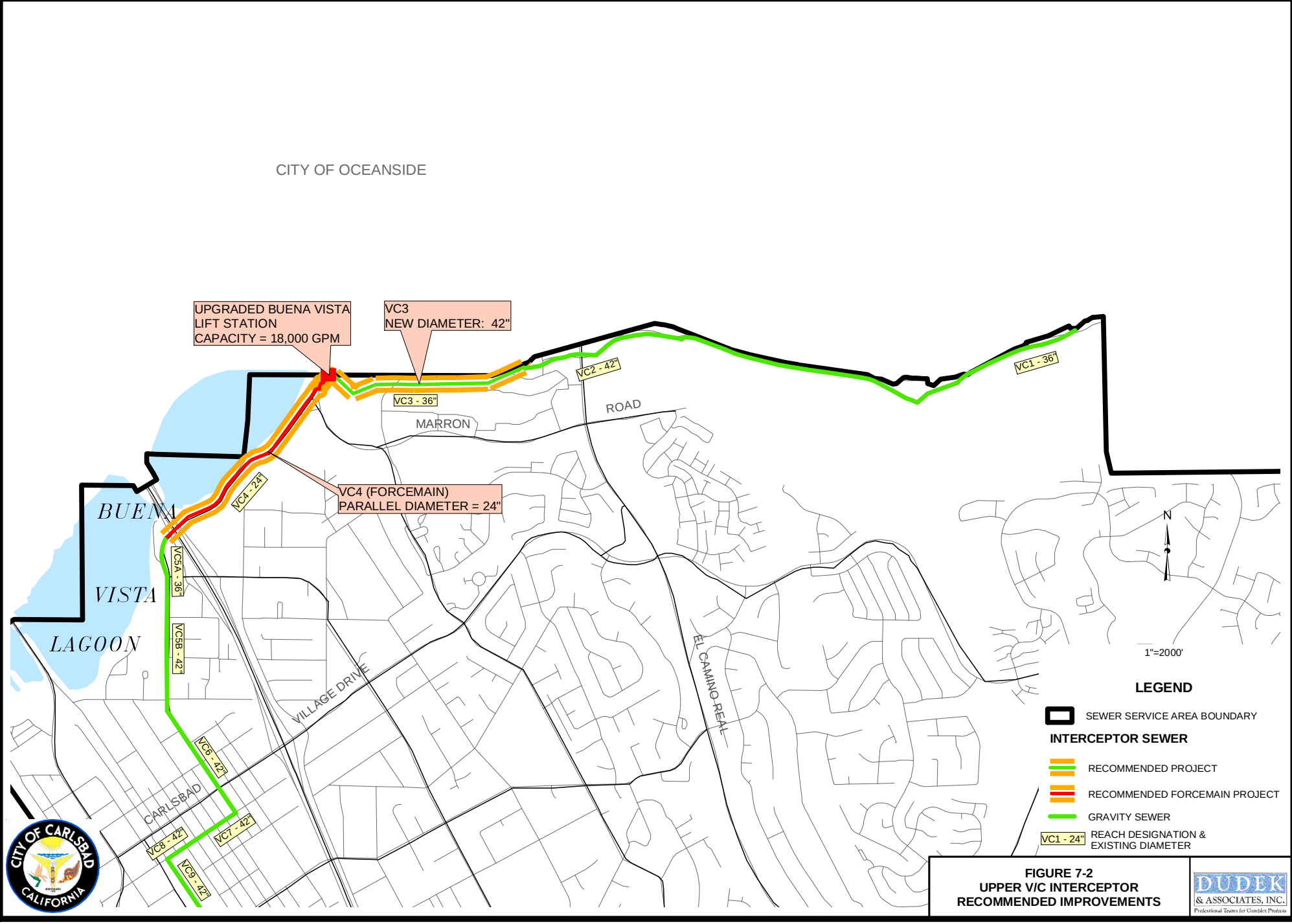


FIGURE 7-2
UPPER V/C INTERCEPTOR
RECOMMENDED IMPROVEMENTS

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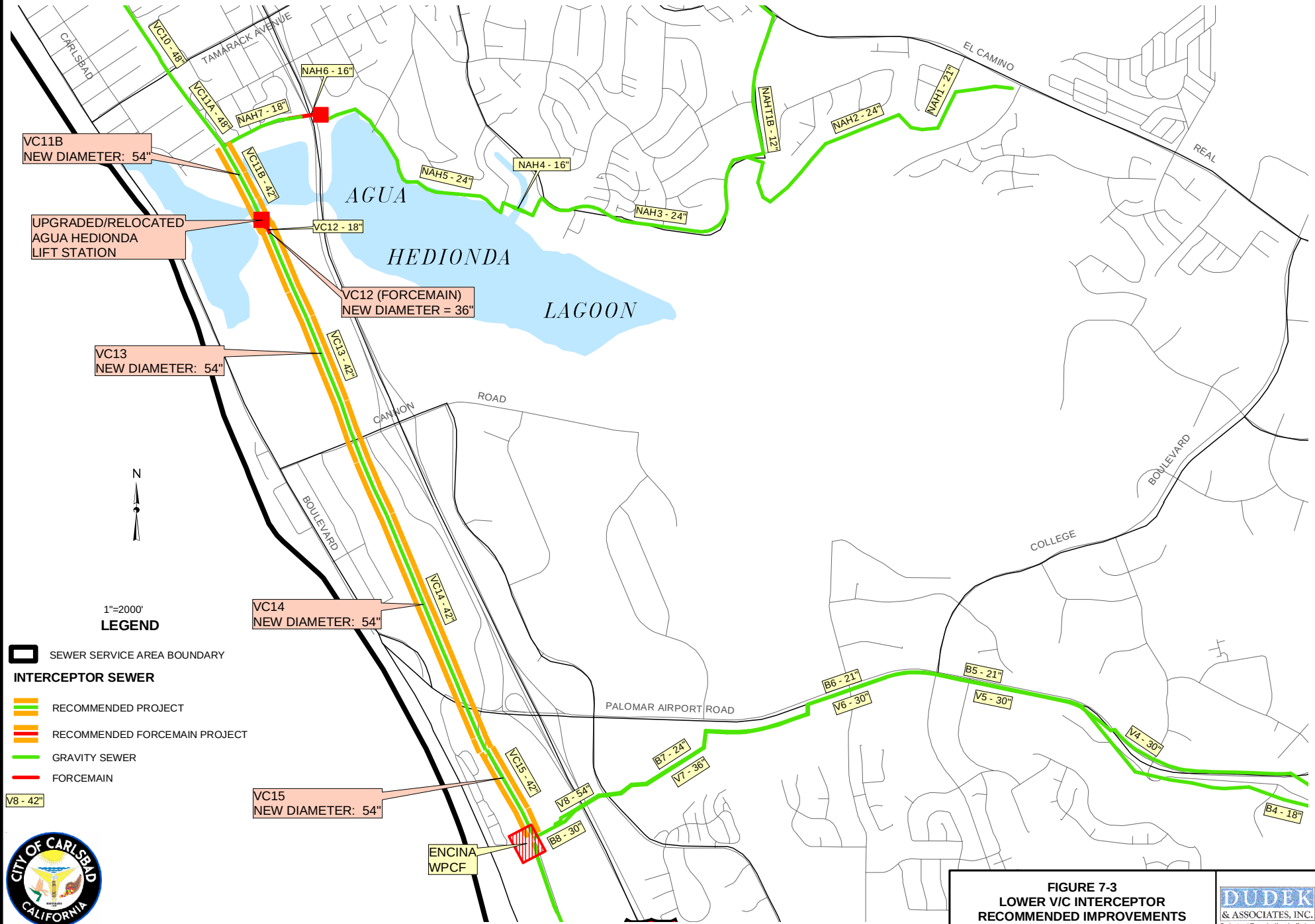

FIGURE 7-3
LOWER V/C INTERCEPTOR
RECOMMENDED IMPROVEMENTS

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Professional Teams for Complex Projects

7.2 SOUTH AGUA HEDIONDA INTERCEPTOR IMPROVEMENTS

Most of the South Agua Hedionda Interceptor has been constructed. The remaining portions of the SAH Interceptor yet to be installed are the SAH Lift Station and forcemain. The force main will have an approximate length of 5,380 feet and be constructed in the future alignment of Cannon Road. A gravity sewer will be constructed with the forcemain that will connect with a gravity line in Faraday Road and convey flows from the Faraday Business Park and to the SAH Lift Station. After completion of these projects, the two Faraday Lift Stations and the Kelly Lift Station will be removed. The recommended sizes for the remaining the SAH Interceptor projects are illustrated on Figure 7-4.

7.3 LIFT STATION IMPROVEMENTS

A capacity analysis of the lift stations included in the major interceptor systems was performed and documented in Section 6.7.7 of this report. Capacity improvements based on projected ultimate peak flows are recommended for the Buena and Agua Hedionda Lift Stations.

A detailed survey of the lift stations with respect to the condition, code compliance, standby power and capacity was performed as part of the 1997 Master Plan Update. A summary of the pertinent recommended improvements is provided in Table 7-2. For each station, the installation of gas detectors to monitor for hydrogen sulfide and other combustible gases was recommended. This is a requirement of existing codes included in Title 8 of the California Code of Regulations and the National Fire Protection Association Article 820. Continuously operating ventilation fans and airflow switches were also recommended for code compliance. It was recommended that an alarm be added for ventilation fan failure. Each of the station wet wells was found to have a mercury float that needs to be modified/changed to meet the requirement of a Class 1, Division 1 section of the National Electrical Code.

Table 7-2
LIFT STATION RECOMMENDED IMPROVEMENTS

Lift Station Name	Construction/ Rehabilitation Date	RECOMMENDED IMPROVEMENT					
		Gas Detectors	Ventilation Modifications	Alarms	Standby Generator Connector	Wiring Repairs	Float Switch Modifications
Terramar	1972	X	X	X		X	X
Chinquapin	1959/2001	X	X				X
Home Plant	1963/1991	X	X			X	X
Gateshead	1985	X	X			X	X
Vancouver	1981	X	X	X		X	X
Simsbury	1985	X	X			X	X
Villas	1983	X	X				X
Woodstock	1983	X	X			X	X
North Batiquitos	1997	X					X
La Golondrina	1981	X	X	X	X	X	X

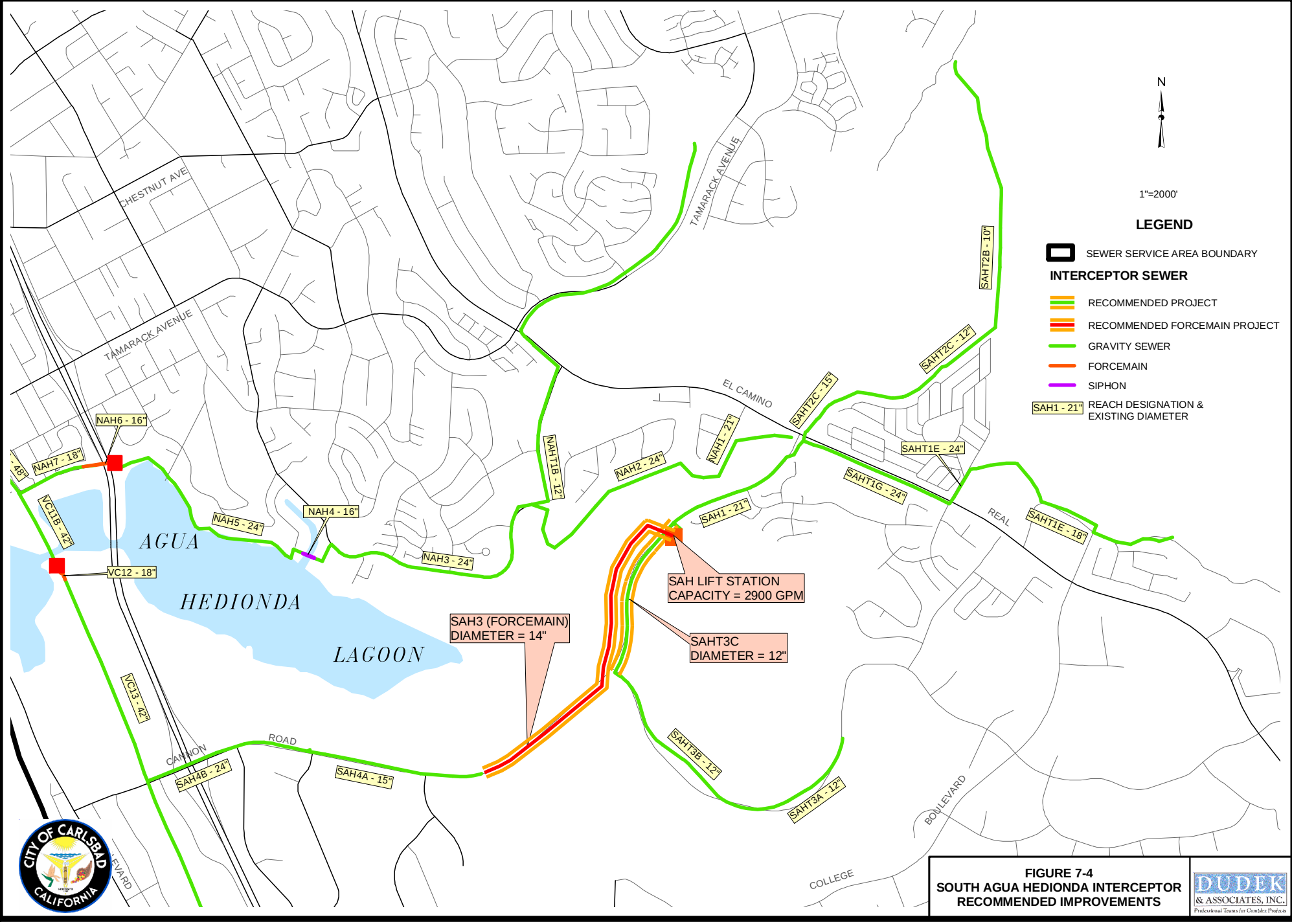

FIGURE 7-4
SOUTH AGUA HEDIONDA INTERCEPTOR
RECOMMENDED IMPROVEMENTS

DUDEK & ASSOCIATES, INC.
Professional Teams for Complex Projects

7.4 POTENTIAL FLOWS FROM OTHER AGENCIES

Currently, interceptors owned or jointly owned by Carlsbad convey flows from the City of Vista, the City of Oceanside (through the City of Vista connection), the LCWD, and the Encinitas Sanitary Division of the City of Encinitas (through the LCWD connection). Future opportunities to convey additional flows were evaluated in this Master Plan Update. The City of Oceanside had previously expressed a desire to convey flows from their Leisure and Lake Lift Stations into an eastward extension of the SAH Interceptor. The trunk sewer extension, previously identified as SAHT2A in the 1992 Master Plan, was located in an area that is now designated as open space. City staff have stated that it is highly unlikely that this trunk sewer would ever be constructed, and these additional flows from Oceanside were not included in the ultimate flow projections. Also, the City of Vista no longer desires to convey flows by gravity from the Raceway Lift Station service area to a separate eastward extension of the SAH Interceptor. As a result of this and additional environmental constraints, the previously planned trunk sewer, identified as Reaches SAHT1A-1D in the 1992 Master Plan, will no longer be constructed. Wastewater flows from Sub-basins 18A and 16 will now be pumped and discharge to a downstream location on the SAH Interceptor.

In the far southeast corner of the City of Carlsbad service area, one possible future annexation may occur that would affect wastewater flows. Wastewater from Carlsbad Tract 93-04 (28 units) currently flows to the LCWD Meadows III Pump Station. Wastewater from these units will flow by gravity into the Vallecitos Interceptor once a gravity pipeline is constructed. When the gravity system is in place, the LCWD may want to de-annex 68 units within its boundary, which would allow the Meadows III Pump Station to be abandoned. There is projected to be ample capacity in the Vallecitos Interceptor for these additional flows.

7.5 JOINT TRANSMISSION SYSTEMS

The District shares ownership or leases capacity in several facilities with the City of Vista, the Buena Sanitation District, the Vallecitos Water District, the Leucadia County Water District and Encinitas Sanitary Division of the City of Encinitas. These facilities include the V/C Interceptor, the Buena Interceptor, the Vallecitos Interceptor and the Occidental Sewer. The following discussions provide an overview of these facilities relative to projected ultimate wastewater flow conditions.

Vista/Carlsbad Interceptor. The Vista/Carlsbad Interceptor ownership percentages and capacity rights from the 2001 draft agreement with the City of Vista are provided in Table 3-1 of this report. Based on the agreement, Carlsbad has a 43.9% ownership in the downstream reach of the V/C Interceptor (VC15). Projected flows for Carlsbad are now lower, and the percentage of flow for Carlsbad in this reach is now estimated at 37.2%. It is recommended that a new agreement be negotiated based on the updated flow projections in this Master Plan Update.

Buena Interceptor. The City of Carlsbad leases capacity in the Buena Interceptor. The existing lease agreement was last modified in 1987 to lease an additional 0.8 MGD of capacity. It is estimated that Carlsbad will not require any additional capacity in this interceptor to convey projected ultimate flows. It is noted that the existing Buena Interceptor does not have the capacity to convey buildout flows based on ultimate flow projections for the BSD and the City of Vista Raceway Basin. The City of Vista includes a project in their 2001 Master Plan to construct a new force main from the Buena and Raceway Lift Stations to the Vallecitos Interceptor.

Vallecitos Interceptor. The City of Carlsbad currently leases 5.0 MGD of capacity in the Vallecitos Interceptor. City of Carlsbad ultimate peak flows in this interceptor are projected to be less than 3.5 MGD. The existing interceptor does not have the capacity to convey buildout flows for the VWD and future flows from the BSD and the City of Vista Raceway Basin. The VWD plans to replace the existing Vallecitos Interceptor with a larger capacity interceptor. Based on projected ultimate flows, Carlsbad could reduce their leased capacity to approximately 4.0 MGD.

Occidental Sewer. The Occidental Sewer is jointly owned by the City of Carlsbad, the ESD and the LCWD. Carlsbad's current ownership capacity, which is estimated to be approximately 8.5 MGD, is projected to be approximately 4.0 MGD in excess of what is required to convey the ultimate PWWF. The LCWD projects that they will need to acquire an additional 1.6 MGD of conveyance capacity in the Occidental Sewer in their most recent Master Plan. It is recommended that the ownership capacities defined in the 1972 Occidental Pipeline Agreement be updated based on current flow projections.

7.6 TREATMENT CAPACITY REQUIREMENTS

Wastewater generated within the City of Carlsbad service area is collected and conveyed to the Encina Water Pollution Control Facility (WPCF) for treatment and subsequent disposal. Carlsbad currently owns a total treatment capacity of 9.24 MGD in the Encina WPCF, and has requested additional capacity to total 10.26 MGD in the planned Encina WPCF Phase V expansion. Existing ADWF generation is approximately 6.8 mgd. Based on projected wastewater production increases, the City of Carlsbad is projected to generate an average dry weather volume of approximately 9.87 MGD at buildout, which is anticipated to occur by the year 2020.

The requested treatment capacity is approximately 0.4 MGD, or 4 percent greater than the projected ultimate flows. However, should the "per capita" water usage of customers decrease or increase in the future, the projected treatment capacity surplus would likewise be reduced or increase. As a policy matter, the Board of Directors needs to establish the standard for redundancy that it believes prudent for treatment capacity at the EWA. The established redundancy standard will influence the final decision regarding the City's participation in future expansion projects at the EWA facility.

7.7 OCEAN OUTFALL CAPACITY

Wastewater tributary to the Encina WPCF is treated to secondary standards and discharged to the Pacific Ocean through the Encina Ocean Outfall. Capacity rights in the outfall are based on the PWWF. This outfall facility has an estimated capacity of 104.9 MGD. The District owns 24.32 percent of the available capacity, or 25.51 MGD. Because flows to the Encina WPCF from the City of Carlsbad are determined by subtracting upstream agency flows, the peak flow contribution from Carlsbad cannot be easily determined from meter records. In the ultimate system hydraulic model, approximately 6.9 MGD of peak I/I generated within Carlsbad was included in the model. This flow rate is based on historical flow data from storm events and an assumed I/I increase of twenty percent to account for aging of the pipelines and expansion of the collection system. By removing all flow from upstream agencies in the model, the ultimate PWWF to the Encina WPCF from the City of Carlsbad is estimated to be approximately 25.0 MGD. The projected PWWF is approximately 2.5 times the ADWF and is just under the City of Carlsbad's existing outfall capacity rights. Therefore no change is recommended to Carlsbad's proportion of the outfall capacity.

7.8 INFLOW AND INFILTRATION STUDY

Flow increases in the V/C Interceptor during storm events are very high due to I&I from both Vista and Carlsbad, which can be observed from existing flow records (see Appendix C). Instantaneous storm water flows originating in the Carlsbad portion of the V/C Interceptor can be estimated from subtracting Vista Meter flows from flows at the Encina WPCF. However, there is no further data to determine the primary locations of the storm water ingress. Pipelines along the Buena Vista Lagoon, the low-lying downtown area, and pipelines in the NAH Interceptor along the Agua Hedionda lagoon are considered likely sources. A detailed I&I study is recommended to locate the I&I sources, estimate the volume increase due to prolonged storm water induced infiltration, and recommend improvements to reduce the flows. In the absence of such detailed information, the I/I rate used in the ultimate system hydraulic analysis was calculated based on the following procedure:

- I/I rates were determined from recorded EWA meter data from the storm event on November 24, 2001, in which 1.3 inches of rain fell in 4 hours.
- The measured I/I was added to the PDWF, so that peak storm flows coincide with the peak daily flow throughout the interceptor system.
- An additional infiltration rate of 3.0 MGD was added to the upstream reach of the V/C Interceptor. This flow rate is based on an analysis of Vista meter records, and accounts for the increase in infiltration that would occur in the Vista system if several severe storms had preceded the November 2001 storm.
- Existing I/I flows as determined from the Encina meters were increased by 20 percent in the ultimate system analysis to account for aging of the pipelines.

It is noted that a much more severe storm in the future could potentially result in higher peak flows than what are assumed for this analysis. Conversely, an aggressive program to identify and reduce the volume of I&I could result in reduced peak flows in the future.

7.9 RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

Improvement projects identified for the Capital Improvement Program (CIP) are summarized in Table 7-3. The projects are arranged into three groups. The first group of projects includes improvements to the sewer collector system and rehabilitation projects. These projects were updated from the City's 2002-2003 CIP based on discussions with City staff. The next group consists of interceptor capacity projects, which were identified from the hydraulic analysis performed as part of this Master Plan Update. The last group of projects are for improvements at the Encina Water Pollution Control Facility, which were also defined in the City's 2002-2003 CIP.

Table 7-3 includes a planning level estimate of probable construction costs. Costs should be considered relative to the 2002 Engineering News Record Construction Cost Index (ENR CCI) of 6538. Cost estimates for the Encina WPCF projects and most of the collector system projects were obtained from the City's 2002-2003 CIP. It is noted that costs identified for V/C Interceptor capacity improvements represent the total cost, although a portion of these costs will be shared by the City of Vista. The costs for the Encina WPCF projects represent the City's pro-rated share for the projects.

Table 7- 3
RECOMMENDED SEWER CAPITAL IMPROVEMENT PROGRAM

Project ID	Description/Location	Project Type	Size/Quantity	Probable Constr. Cost
COLLECTOR SYSTEM & REHABILITATION PROJECTS:				
1	Avenida Encinas Gravity Sewer - new sewer along north side of Lanakai Mobil Home Park to reduce odors	new gravity sewer	1000' of 8" pipeline	$ 175,000
2	North Agua Hedionda Interceptor Rehabilitation - West Segment (Cove Dr. to Hoover St.) - rehab manholes, new access road, erosion protection, minor sewer realignment, EIR, construct mitigation site	rehab manholes, new access road, sewer realignment	19 manholes 700' of 24" pipeline	$ 3,629,000
3	North Agua Hedionda Interceptor Rehabilitation - East Segment (ECR to Kelly Dr.) - replace/rehabilitate manholes	rehab/replace manholes	21 manholes	$ 620,000
4	North Agua Hedionda Trunk Sewer Replacement (Reach NAHT1A)- Tamarack Av. from ECR to Calavera Hills Treatment Plant	replace FM with gravity sewer	5000' of 8" pipeline	$ 1,533,000
5	North Batiquitos Interceptor Rehabilitation - MH Rehab & new access road from ECR west to NB Lift Station	access road & MH rehab	---	$ 1,000,000
6	El Camino Sewer - Construct gravity sewer in ECR from Chestnut Av. To Tamarack Av.	new gravity sewer	4200' of 8" pipeline	$ 420,000
7	Sewer Lift Stations Repairs/Upgrades - Terramar, Villas and Gateshead Lift Stations	Lift Station Upgrades	---	$ 235,000
8	Remove Forest Lift Station and construct gravity sewer using microtunelling construction	new gravity sewer	1400' of 8" pipeline	$ 800,000
9	Home Plant Lift Station - replace pumps, upgrade wetwell, manifold piping, ventilation system, and reconstruct influent gravity sewer	L.S. Improvements & gravity sewer	260' of 15" pipeline	$ 585,000
10	Remove LCWD La Costa Meadows Lift Station and construct gravity sewer	new gravity sewer	600' of 8" pipeline	$ 175,000
11	Remove La Golondrina Lift Station and construct gravity sewer	new gravity sewer	1000' of 8" pipeline	$ 150,000
12	Poinsettia Lift Station Odor and Noise Abatement	L.S. rehab	---	$ 221,800
13	Sewer Line Refurbishment/Replacement - replace or refurbish sewer lines older than 30 years	replace/refurbish gravity sewers	---	$ 7,868,000
14	Vista/Carlsbad Interceptor Rehabilitation Reaches VC1 and VC2 - line pipelines and rehab manholes	line sewers & rehab manholes	9,430' of 36" pipeline 25 manholes	$ 377,000

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Table 7- 3 *(continued)*

Project ID	Description/Location	Project Type	Size/Quantity	Probable Constr. Cost
COLLECTOR SYSTEM & REHABILITATION PROJECTS *(continued)* :				
15	Gateshead Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	200' of 8" pipeline	$ 60,000
16	Vancouver Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	300' of 8" pipeline	$ 60,000
17	Simsbury Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	500' of 8" pipeline	$ 100,000
18	Villas Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	2000' of 8" pipeline	$ 270,000
19	Woodstock Lift Station -remove station & construct new gravity sewer	L.S. replacement with gravity sewer	400' of 8" pipeline	$ 80,000
20	Faraday #14 (Upper) Lift Station - remove station & connect to existing gravity sewer	L.S. replacement with gravity sewer	---	$ 30,000
21	Faraday #10 (Lower) Lift Station - remove station & connect to existing gravity sewer	L.S. replacement with gravity sewer	---	$ 30,000
22	North Batiquitos L.S. Modifications- new gas detectors, ventilation system, odor control, improved pump access, wiring, & float switch	L.S. rehab	---	$ 500,000
23	Carlsbad Trunk Sewer Reaches VCT1A, VCT1B, VCT1C - Convey flows from Vancouver and Simsbury Lift Station service areas through LFMZ25 to the V/C Interceptor (see related projects 16 & 17)	new gravity sewer	2000' of 8" pipeline	$ 150,000
24	Master Plan Update - update of sewer MP and CEQA approval	prepare reports	--	$ 305,000
25	Sewer Monitoring Program - monitor sewer flows in pipelines and at lift stations	monitor flows	--	$ 600,000
26	Sewer Access Hole Rehabilitation - replace or refurbish manholes older than 30 years	rehab/replace manholes	--	$ 2,800,000
27	Sewer Connection Fee Update	prepare report	--	$ 15,000
			Collector System & Rehabilitation Projects Subtotal	**$ 22,789,000**

continued next page

Table 7- 3 *(continued)*

Project ID	Description/Location	Project Type	Size/Quantity	Probable Constr. Cost
INTERCEPTOR CAPACITY PROJECTS:				
28	Vista/Carlsbad Interceptor Reach VC3 - capacity upgrade upstream of the Buena Vista Lift Station	interceptor replacement	3,350' of 42" pipeline	$ 2,570,000*
29	Buena Vista Lift Station - capacity increase, control system upgrade, new back-up generator	L.S. rehab	Lift Station capacity = 26 MGD	$ 735,000*
30	Buena Vista Lift Station Force Main (VC4) - replace existing 16" pipeline with 24" pipeline to provide dual 24" FMs & increase capacity	new force main	3,840' of 24" force main	$ 1,244,000*
31	Vista/Carlsbad Interceptor Reach VC11B - upgrade capacity and construct new bridge crossing over the Agua Hedionda Lagoon	interceptor replace-ment & new bridge	915' of 54" pipeline	$ 2,900,000*
32	Agua Hedionda Lift Station and Force Main VC12 - rehab lift station and construct new force main	L.S. rehab & new force main	Lift station capacity = 36 MGD 200' of 36" force main	$ 6,250,000*
33	V/C Interceptor Reaches VC13, VC14 & VC15 - Increase interceptor capacity from the AH Lift Station to Encina WPCF	interceptor replacement	3510' of 54" pipeline 6,831' of 60" pipeline	$ 10,200,000*
34	South Agua Hedionda Lift Station and Force Main - construct lift station, force main and gravity sewer in Cannon Rd., remove Kelly Lift Station	New L.S., FM & gravity sewer	Lift Station capacity = 4.2 MGD 5,380' of 14" force main 2,568' of 12" gravity pipeline	$ 8,827,000
			Interceptor Capacity Projects Subtotal	**$ 32,726,000**
ENCINA WATER POLLUTION CONTROL FACILITY PROJECTS:				
35	Encina WPCF Building Improvements	improve building	---	$ 1,787,000
36	Capital Acquisitions - Unit 1	acquisitions	---	$ 3,415,000
37	Capital Planning/Services	planning	---	$ 1,910,000
38	Cogeneration Project - upgrade of the electrical generators	facility upgrade	---	$ 581,000
39	Flow Equalization Project - construct tank for peak effluent flows	construct tank	---	$ 8,189,000
40	Phase IV Expansion - Debt Service on Phase IV plant expansion	debt service	---	$ 13,082,000
41	Phase V Expansion - expand plant capacity for buildout conditions	TP expansion	---	$ 11,693,000
42	Phase V Expansion - Interim capacity improvements	TP expansion	---	$ 222,000
43	Plant Rehabilitation	machinery rehab	---	$ 2,909,000
44	Pump Station Interfaces - develop active flow monitoring system	report	---	$ 60,000
45	Technology Master Plan	report	---	$ 1,161,000
			Encina WPCF Projects Subtotal	**$ 45,009,000**
			CAPITAL IMPROVEMENT PROJECT TOTAL =	**$ 100,524,000**

* Costs for V/C Interceptor capacity improvememnts includes Vista's share of

CHAPTER 8
SEWER CONNECTION FEE UPDATE

The City of Carlsbad has historically charged connection fees to provide sewer service to its new customers. The fees pay for the planning, design and construction of capacity improvements and/or new facilities required for the conveyance and treatment of sewage. Under California State law, connection fees must be based on relevant capital costs. This chapter provides an updated basis for sewer connection fees based on growth projections and capital improvement projects identified to serve future development. A cash flow analysis is performed with the updated connection fee from a starting date of October 1, 2003 through buildout, which is projected to occur by 2020.

8.1 BACKGROUND

Sewer connection fees are used to generate revenue to construct sewer infrastructure needed to support new development. Assembly Bill 1600 was incorporated into the California Government Code under Title 7, Division 1, Chapter 5: "Fees for Development Projects", effective 1989. Chapter 5 states that any fee imposed by a local agency must show that the fee will be used only for purposes related to the service for which the fee is assessed. The law requires that the City of Carlsbad: 1) identify the purpose of the fee, 2) identify the use for which the fee is to be put, 3) show a relationship between the fee's use and the type of development project on which the fee is imposed, and 4) show a relationship between the need for the facility and the type of development project on which the fee is imposed. This chapter provides the basis for connection fees needed to satisfy California law.

The current sewer connection fee was developed in 1990 as part of the "Capacity Fee Update to the 1987 Master Plan of Sewerage". The fee is based on the Equivalent Dwelling Unit (EDU) method. An EDU is a unit of measure for the sewage generated from particular buildings, structures or uses. One EDU is equal to an approximation of the amount of sewage generated by an average single-family residence. The City uses a formula to determine the EDU's for other residential, commercial and industrial users. The sewer connection fee is adjusted annually, effective July 1st, according to the Engineering News Record Los Angeles Construction Cost Index. The 2002-2003 sewer connection fee is $2,060 per EDU.

In the City of Carlsbad, many sewer projects are paid for by Sewer Benefit Area (SBA) Fees. These developer-paid fees provide direct funding for specific projects. The sewer benefit area fee program was originally approved by the City Council on January 15, 1991. The SBA fee is collected with the issuance of building permits within defined sewer benefit areas. Some developments are conditioned to construct specific facilities prior to or concurrent with the issuance of building permits. In these cases, reimbursement is given for actual costs through the SBA fee. A SBA fee program has been established to pay for portions of the South Agua Hedionda (SAH) Interceptor. The SAH Interceptor system is therefore considered to be "developer funded". This project and other projects constructed with SBA fees are not included in the connection fee calculations.

8.2 GROWTH PROJECTIONS

The total number of future users must be estimated to calculate connection fees. The City of Carlsbad Growth Database is used in this Master Plan Update to determine the number of future users and project the ultimate sewer flow for the capacity analysis (documented in Chapter 6, Section 6.3). Parcels in the Growth Database are assigned to one of 25 Local Facility Management Zones (LFMZ), illustrated previously on Figure 1-3. For the connection fee update, an updated version of the Growth Database is used to determine the number of future users. In the updated Growth Database, future users are based on development that is projected to occur after October 1, 2003.

Growth data in the updated Growth Database consists of the number of projected residential units and the estimated building area for commercial and industrial parcels at build-out. Sewer connection fees are currently assessed based on Equivalent Dwelling Units (EDUs). By definition, one EDU will generate the equivalent amount of sewage as an average single-family residence, which is estimated to be 220 gallons per day (gpd). EDU conversions for other types of development are defined in Table 13.10.020-c of the Carlsbad Municipal Code. For commercial developments, the gross floor area of the building in square feet (sqft) is divided by 1,800 to obtain the number of EDUs. This is equivalent to a sewage generation rate of 1,225 gpd per 10,000 sqft of building area or 5.6 EDUs/10,000 sqft. For industrial developments the building area is divided by 5,000, which is equivalent to a sewage generation rate of 440 gpd per 10,000 sqft of building area, or 2 EDUs/10,000 sqft. The projected future EDUs within the City of Carlsbad Sewer Service Area after October 1, 2003 are summarized in Table 8-1.

Table 8-1
PROJECTED FUTURE EDUs WITHIN THE SEWER SERVICE AREA

LFMZ	Future Development			EDUs*	LFMZ	Future Development			EDUs*
	Residential Units	Building Area (sqft)				Residential Units	Building Area (sqft)		
		Commercial	Industrial				Commercial	Industrial	
1	689	1,016,581	0	1,254	15	550	275,000	0	703
2	140	39,656	0	162	16	0	0	1,413,522	283
3	12	128,551	20,000	87	17	598	268,000	2,170,000	1,181
4	40	0	0	40	18	0	30,000	2,196,000	456
5	0	0	2,496,687	499	19	84	223,637	0	208
7	705	30,000	0	722	20	497	70,750	0	536
8	256	6,000	0	259	21	392	0	0	392
9	1	411,500	0	230	22	222	84,780	0	269
10	489	0	0	489	24	30	0	0	30
13	0	1,109,692	200,000	656	25	130	0	0	130
14	960	0	0	960					
Totals:	**5,795 residential units**				**12,190,356 sqft of building area**				**9,547 EDUs**

* Non-residential EDU conversions are: commercial = building area/1800, industrial = building area/5000

8.3 CAPITAL COSTS FOR CAPACITY IMPROVEMENTS

The purpose of the sewer connection fee is to pay for growth related capacity improvements. All of the wastewater generated within the City of Carlsbad Sewer Service Area is treated at the Encina WPCF. The connection fee therefore recovers the cost of capital improvements and expansions to the sewer interceptor system and the Encina Water Pollution Control Facility (WPCF).

The basis of improvement projects for the connection fee is the Capital Improvement Program (CIP) previously identified in Table 7-1 of this Master Plan Update. The CIP recommends improvements to the sewer interceptor system and the Encina WPCF that will be needed to support the build-out population of the Sewer Service Area, including replacement of existing facilities and maintenance–related projects. However, only the capacity-related projects identified to accommodate future growth are included in the connection fee calculations. In the City of Carlsbad, developers provide direct funding for many specific projects through Sewer Area Benefit Fees. These projects, which include construction of the South Agua Hedionda Interceptor, pump station and force main, are not included in the sewer connection fees.

The capacity related capital improvement projects required for future development and an estimate of probable costs are summarized in Table 8-2 for the connection fee update. Also shown in this table is the proposed project phasing. Project costs reflect future planned expenditures based on the City of Carlsbad 2003-2004 Capital Improvement Program, which exclude funds appropriated for the 2002-2003 fiscal year. Projected costs for projects that are currently active will therefore differ from the CIP costs included in Table 7-1, which are based on the 2002-2003 CIP.

Project costs listed in Table 8-2 for improvements to the Vista/Carlsbad Interceptor (project numbers 28-33) reflect only the City of Carlsbad's cost share. Carlsbad's cost share is based on the capacity rights defined in Exhibit B of the February 8, 2000 Revised Joint Sewage System Agreement with the City of Vista (provided in Table 3-1 of this Master Plan Update). Costs for projects 28 through 30 are based on a 10.4 percent ownership, projects 31 and 32 are based on a 30.9 percent ownership, and project 33 is based on a 43.9 percent ownership. Encina WPCF project costs are based on the City of Carlsbad's current capacity ownership of the Encina WPCF, as documented in the February 2000 Revised Basic Agreement. The total cost of projects to be funded from connection fees is estimated at approximately $31,297,000.

8.4 CONNECTION FEE CALCULATIONS

A cost per EDU for sewer service can be determined from the CIP costs and the projected number of future users, which has been estimated from available planning data. Because the actual number of units eventually constructed may vary, the estimate of future sewer EDUs is reduced by 10 percent in the calculation of sewer connection fees. This unit reduction is considered a "safety factor" to ensure that the necessary fees will be collected even if the Sewer Service Area is not completely buildout as planned.

Table 8-2
CAPITAL IMPROVEMENT PROJECTS FOR THE SEWER CONNECTION FEE UPDATE

CIP NO.	MASTER PLAN PROJECT DESCRIPTION/LOCATION	PROJECT TYPE	ESTIMATED COST	FUTURE YEAR BUDGET AMOUNTS						
				YEAR 1 2003-2004	YEAR 2 2004-2005	YEAR 3 2005-2006	YEAR 4 2006-2007	YEAR 5 2007-2008	YEAR 6-10 2009-2013	BUILDOUT 2014-2020
24	Master Plan Update and CEQA approval for CIP	prepare report	$ 305,000						$ 305,000	
25	Sewer Monitoring Program - monitor flows in pipelines and at lift stations	monitor flows	$ 340,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 100,000	$ 140,000
27	Sewer Connection Fee Update	prepare report	$ 15,000						$ 15,000	
28	Vista/Carlsbad Interceptor Reach VC3 - capacity upgrade upstream of the Buena Vista Lift Station	interceptor replacement	$ 267,000*			$ 267,000				
29	Buena Vista Lift Station - capacity increase, control system upgrade, new back-up generator	L.S. rehab	$ 233,000*	$ 233,000						
30	Buena Vista Lift Station Force Main, VC4 - replace 16" pipeline with 24" pipeline to provide dual 24" force mains & increase capacity	new force main	$ 129,000*						$ 129,000	
31	Vista/Carlsbad Interceptor Reach VC11B - upgrade capacity & construct new bridge crossing over the Agua Hedionda Lagoon	interceptor replacement & new bridge	$ 896,000*						$ 896,000	
32	Agua Hedionda Lift Station and Force Main, VC12 - rehab lift station, increase capacity and construct new force main	L.S. rehab & new force main	$ 1,931,000*		$ 348,000	$1,583,000				
33	V/C Interceptor Reaches VC13, VC14 & VC15 - Increase interceptor capacity from the AH Lift Station to the Encina WPCF	interceptor replacement	$ 4,478,000*		$ 224,000	$2,060,000	$2,194,000			
40	Encina Phase IV Expansion - debt service on Phase IV plant expansion	debt service	$ 11,203,800	$ 936,300	$ 939,600	$ 936,400	$ 933,900	$ 935,500	$ 4,665,500	$ 1,856,600
41	Encina Phase V Expansion - expand plant capacity for buildout conditions	TP expansion	$ 11,499,000		$11,499,000					
TOTALS:			**$ 31,296,800**	**$1,189,300**	**$13,030,600**	**$4,866,400**	**$3,147,900**	**$955,500**	**$6,110,500**	**$1,996,600**

* Cost for V/C Interceptor projects is the City of Carlsbad's share based on capacity rights defined in Exhibit B of the 2/8/2000 Revised Joint Sewage System Agreement

The calculations for the updated connection fee are shown in Table 8-3. The "Total Cost" in Table 8-3 is the capital budget minus the available cash balance in the sewer connection fee account. City Staff have projected the available cash balance on October 1, 2003 to be $23,330,674. The new connection fee is calculated to be $927 per EDU.

Table 8-3
SEWER CONNECTION FEE CALCULATION

Capital Budget	Available Cash Balance	Total Cost	Future EDUs less 10%	Cost Per EDU
$31,296,800	$23,330,674	$7,966,126	8,592	$927

8.5 SEWER SYSTEM CASH FLOW ANALYSIS

A cash flow table can be constructed using the sewer connection fee calculated in Table 8-3, yearly buildout projections provided in the City of Carlsbad Growth Database, and project phasing estimates. Table 8-4 provides a sewer cash flow table using the calculated connection fee over a seventeen-year period, starting in October 1, 2003 and ending at 2020, which is the projected buildout year for the City. At the end of the chosen time period the cumulative balance is $0, because the connection fees are based on a budget that includes the available cash balance. It is noted that all values used in the cash flow tables are in current dollars.

Table 8-4
SEWER CONNECTION FEE CASH FLOW ANALYSIS

Fiscal Year	New EDUs	Connection Fee	Revenue	CIP Costs	Balance	Cumulative Balance
				Available cash balance projected for 10/1/03 =		$ 23,330,674
2003	442	$927	$ 409,803	$ 1,189,300	$ (779,497)	$ 22,551,177
2004	878	$927	$ 814,043	$ 13,030,600	$ (12,216,557)	$ 10,334,620
2005	784	$927	$ 726,890	$ 4,866,400	$ (4,139,510)	$ 6,195,111
2006	860	$927	$ 797,354	$ 3,147,900	$ (2,350,546)	$ 3,844,565
2007	630	$927	$ 584,108	$ 955,500	$ (371,392)	$ 3,473,173
2008	782	$927	$ 725,036	$ 1,222,100	$ (497,064)	$ 2,976,109
2009	682	$927	$ 632,321	$ 1,222,100	$ (589,779)	$ 2,386,330
2010	599	$927	$ 555,367	$ 1,222,100	$ (666,733)	$ 1,719,597
2011	543	$927	$ 503,446	$ 1,222,100	$ (718,654)	$ 1,000,942
2012	491	$927	$ 455,234	$ 1,222,100	$ (766,866)	$ 234,076
2013	425	$927	$ 394,041	$ 249,575	$ 144,466	$ 378,542
2014	361	$927	$ 334,703	$ 249,575	$ 85,128	$ 463,671
2015	243	$927	$ 225,299	$ 249,575	$ (24,276)	$ 439,395
2016	188	$927	$ 174,305	$ 249,575	$ (75,270)	$ 364,125
2017	163	$927	$ 151,126	$ 249,575	$ (98,449)	$ 265,677
2018	157	$927	$ 145,564	$ 249,575	$ (104,011)	$ 161,665
2019	218	$927	$ 202,120	$ 249,575	$ (47,455)	$ 114,210
2020	146	$927	$ 135,365	$ 249,575	$ (114,210)	$0
Totals:	**8,592**		**$ 7,966,126**	**$ 31,296,800**	**$ (23,330,674)**	